JAPANESE [JP,2001-045098,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL PROBLEM MEANS DESCRIPTION OF DRAWINGS DRAWINGS

[Translation done.]

* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] It is the data telecommunication system which transmits and receives data through a network between the data communication unit of a transmitting side, and the data communication unit of two or more receiving sides. The data communication unit of said transmitting side A coding means to encode said data hierarchical and to generate coded data, A data generation means for correction to generate the data for error corrections to each coded data encoded hierarchical with this coding means, It has a transmitting means to transmit said coded data encoded hierarchical and data for said error corrections as a respectively different data sequence. The data communication unit of said receiving side The data telecommunication system characterized by having a selection means to choose a suitable data sequence based on a receive state from said respectively different data sequences, and a receiving means to receive the data sequence chosen with this selection means.
[Claim 2] The data sequence transmitted with said transmitting means is a data telecommunication system according to claim 1 characterized by being the fundamental series according to the hierarchy of coding of said data, one or more extended sequences which are the upper layer of these fundamental series, and a data sequence for correction according to each data for correction generated to said data encoded hierarchical.
[Claim 3] Said fundamental series are data telecommunication systems according to claim 2 characterized by surely being chosen from said data sequences by said selection means.
[Claim 4] Furthermore, a data packet-ized means for the data communication unit of said transmitting side to packet-ize the coded data encoded hierarchical with said coding means, and to generate a data packet, It has a data packet-ized means for correction to generate the packet for error corrections using the data for said error corrections. Said data generation means for correction The data for said error corrections are generated using said data packet. Said transmitting means The data telecommunication system according to claim 1 characterized by transmitting said data packet and said packet for error corrections as the data sequence of said coded data, and a data sequence of the data for said error corrections, respectively.
[Claim 5] Said transmitting means is a data telecommunication system according to claim 4 characterized by adding data transmitting time information and the sequence number, and transmitting for every data packet within said data sequence.
[Claim 6] Said data generation means for correction is a data telecommunication system according to claim 4 characterized by generating the data for said error corrections only using the coded data part of this data packet with reference to the data packet of said data encoded hierarchical, and for said data packet-ized means for correction generating a payload header only including information indispensable at the time of an error correction, and generating said packet for error corrections using the data and said payload header for said error corrections.
[Claim 7] The data communication unit of said receiving side is a data telecommunication system according to claim 1 characterized by having further a condition acquisition means to acquire said receive state.
[Claim 8] Said condition acquisition means is a data telecommunication system according to claim 7 characterized by acquiring the rate of a data loss, a transmitting rate, and a receive rate

as said receive state.
[Claim 9] The extended sequence which is a data sequence of the coded data of the upper layer further when said rate of a data loss of said selection means is larger than a threshold [smaller than a predetermined threshold] predetermined in the ratio of said transmitting rate and said receive rate is received. The data sequence for correction received when said rate of a data loss is smaller than a threshold [smaller than a predetermined threshold] predetermined in the ratio of said transmitting rate and said receive rate is reduced. When said rate of a data loss is larger than a larger threshold predetermined in the ratio of said transmitting rate and said receive rate than a predetermined threshold, the data sequence for correction is received further. It is the data telecommunication system according to claim 8 characterized by reducing the extended sequence received when said rate of a data loss is smaller than a larger threshold predetermined in the ratio of said transmitting rate and said receive rate than a predetermined threshold sequentially from the upper layer.
[Claim 10] Said condition acquisition means is a data telecommunication system according to claim 7 characterized by acquiring the rate of a data loss as said receive state.
[Claim 11] When said rate of a data loss is receiving the data sequence smaller than a predetermined threshold for said error corrections, said selection means Reduce the received data sequence for error corrections, and the extended sequence which is a data sequence of the coded data of the upper layer further is received. When said rate of a data loss has not received the data sequence smaller than a predetermined threshold for said error corrections Furthermore, when the extended sequence which is a data sequence of the coded data of the upper layer is received and said rate of a data loss is receiving an extended sequence more greatly than a predetermined threshold It is the data telecommunication system according to claim 10 characterized by receiving the data sequence for said error corrections further when the received extended sequence is reduced, the data sequence for said error corrections is received further and said rate of a data loss has not received the extended sequence more greatly than a predetermined threshold.
[Claim 12] Said predetermined threshold is a data telecommunication system according to claim 9 or 11 characterized by what it opts for according to the coding method of said coded data.
[Claim 13] A data telecommunication system given in claim 1 thru/or any of 12 they are. [which is characterized by the ability to apply to the multicast communication link which carries out the multiple address of the data, such as a dynamic image, to the data communication unit of two or more receiving sides through networks, such as the Internet, from the data communication unit of said transmitting side]
[Claim 14] A coding means to be the data communication unit which transmits data through a network to the data communication unit of two or more receiving sides, and to encode said data hierarchical and to generate coded data, A data generation means for correction to generate the data for error corrections to each coded data encoded hierarchical with this coding means, The data communication unit characterized by having a transmitting means to transmit said coded data encoded hierarchical and data for said error corrections as a respectively different data sequence.
[Claim 15] The data sequence transmitted with said transmitting means is a data communication unit according to claim 14 characterized by being the fundamental series according to the hierarchy of coding of said data, one or more extended sequences which are the upper layer of these fundamental series, and a data sequence for correction according to each data for correction generated to said data encoded hierarchical.
[Claim 16] Said fundamental series are data communication units according to claim 15 characterized by surely being chosen from said data sequences by the data communication unit of said receiving side.
[Claim 17] Furthermore, a data packet-ized means to packet-ize the coded data encoded hierarchical with said coding means, and to generate a data packet, It has a data packet-ized means for correction to generate the packet for error corrections using the data for said error corrections. Said data generation means for correction The data for said error corrections are generated using said data packet. Said transmitting means The data communication unit

according to claim 14 characterized by transmitting said data packet and said packet for error corrections as the data sequence of said coded data, and a data sequence of the data for said error corrections, respectively.
[Claim 18] Said transmitting means is a data communication unit according to claim 17 characterized by adding data transmitting time information and the sequence number, and transmitting for every data packet within said data sequence.
[Claim 19] Said data generation means for correction is a data communication unit according to claim 17 characterized by generating the data for said error corrections only using the coded data part of this data packet with reference to the data packet of said data encoded hierarchical, and for said data packet-ized means for correction generating a payload header only including information indispensable at the time of an error correction, and generating said packet for error corrections using the data and said payload header for said error corrections.
[Claim 20] A data communication unit given in claim 14 thru/or any of 19 they are. [which is characterized by the ability to apply to the multicast communication link which carries out the multiple address of the data, such as a dynamic image, to the data communication unit of two or more receiving sides through networks, such as the Internet,]
[Claim 21] The data communication unit characterized by having a selection means to choose a suitable data sequence based on a receive state from the data sequences which are the data communication units which receive data through a network from the data communication unit of a transmitting side, and are transmitted from the data communication unit of said transmitting side, and a receiving means to receive the data sequence chosen with this selection means.
[Claim 22] The data sequence transmitted from the data communication unit of said transmitting side is a data communication unit according to claim 21 characterized by being the fundamental series according to the hierarchy of coding of said data, one or more extended sequences which are the upper layer of these fundamental series, and a data sequence for correction according to each data for correction generated to said data encoded hierarchical.
[Claim 23] Said fundamental series are data communication units according to claim 22 characterized by surely being chosen from said data sequences by said selection means.
[Claim 24] Furthermore, the data communication unit according to claim 21 characterized by having a condition acquisition means to acquire said receive state.
[Claim 25] Said condition acquisition means is a data communication unit according to claim 24 characterized by acquiring the rate of a data loss, a transmitting rate, and a receive rate as said receive state.
[Claim 26] The extended sequence which is a data sequence of the coded data of the upper layer further when said rate of a data loss of said selection means is larger than a threshold [smaller than a predetermined threshold] predetermined in the ratio of said transmitting rate and said receive rate is received. The data sequence for correction received when said rate of a data loss is smaller than a threshold [smaller than a predetermined threshold] predetermined in the ratio of said transmitting rate and said receive rate is reduced. When said rate of a data loss is larger than a larger threshold predetermined in the ratio of said transmitting rate and said receive rate than a predetermined threshold, the data sequence for correction is received further. It is the data communication unit according to claim 25 characterized by reducing the extended sequence received when said rate of a data loss is smaller than a larger threshold predetermined in the ratio of said transmitting rate and said receive rate than a predetermined threshold sequentially from the upper layer.
[Claim 27] Said condition acquisition means is a data communication unit according to claim 24 characterized by acquiring the rate of a data loss as said receive state.
[Claim 28] When said rate of a data loss is receiving the data sequence smaller than a predetermined threshold for said error corrections, said selection means Reduce the received data sequence for error corrections, and the extended sequence which is a data sequence of the coded data of the upper layer further is received. When said rate of a data loss has not received the data sequence smaller than a predetermined threshold for said error corrections Furthermore, when the extended sequence which is a data sequence of the coded data of the upper layer is received and said rate of a data loss is receiving an extended sequence more

greatly than a predetermined threshold It is the data communication unit according to claim 27 characterized by receiving the data sequence for said error corrections further when the received extended sequence is reduced, the data sequence for said error corrections is received further and said rate of a data loss has not received the extended sequence more greatly than a predetermined threshold.
[Claim 29] Said predetermined threshold is a data communication unit according to claim 26 or 28 characterized by what it opts for according to the coding method of said coded data.
[Claim 30] A data communication unit given in claim 21 thru/or any of 29 they are. [which is characterized by the ability to apply to the multicast communication link to which the multiple address of the data, such as a dynamic image, is carried out through networks, such as the Internet, from the data communication unit of said transmitting side]
[Claim 31] It is the data communication approach applied to the data telecommunication system which transmits and receives data through a network between the data communication unit of a transmitting side, and the data communication unit of two or more receiving sides. The coding step which the data communication unit of said transmitting side encodes said data hierarchical, and generates coded data, The data generation step for correction which generates the data for error corrections to each coded data encoded hierarchical at this coding step, It has the transmitting step which transmits said coded data encoded hierarchical and data for said error corrections as a respectively different data sequence. The data communication unit of said receiving side The data communication approach characterized by having the selection step which chooses a suitable data sequence based on a receive state from said respectively different data sequences, and the receiving step which receives the data sequence chosen at this selection step.
[Claim 32] The data sequence transmitted at said transmitting step is the data communication approach according to claim 31 characterized by being the fundamental series according to the hierarchy of coding of said data, one or more extended sequences which are the upper layer of these fundamental series, and a data sequence for correction according to each data for correction generated to said data encoded hierarchical.
[Claim 33] Said fundamental series are the data communication approaches according to claim 32 characterized by surely being chosen from said data sequences in said selection step.
[Claim 34] Furthermore, the data packet-ized step which the data communication unit of said transmitting side packet-izes the coded data encoded hierarchical at said coding step, and generates a data packet, It has the data packet-ized step for correction which generates the packet for error corrections using the data for said error corrections. At said data generation step for correction The data for said error corrections are generated using said data packet. At said transmitting step The data communication approach according to claim 31 characterized by transmitting said data packet and said packet for error corrections as the data sequence of said coded data, and a data sequence of the data for said error corrections, respectively.
[Claim 35] The data communication approach according to claim 34 characterized by adding data transmitting time information and the sequence number, and transmitting for every data packet within said data sequence at said transmitting step.
[Claim 36] The data communication approach according to claim 34 characterized by generating the data for said error corrections only using the coded data part of this data packet with reference to the data packet of said data encoded hierarchical, generating the payload header which includes only information indispensable at the time of an error correction at said data packet-ized step for correction, and generating said packet for error corrections at said data generation step for correction using the data and said payload header for said error corrections.
[Claim 37] The data communication unit of said receiving side is the data communication approach according to claim 31 characterized by having further the condition acquisition step which acquires said receive state.
[Claim 38] The data communication approach according to claim 37 characterized by acquiring the rate of a data loss, a transmitting rate, and a receive rate as said receive state at said condition acquisition step.
[Claim 39] At said selection step, the extended sequence which is a data sequence of the coded

data of the upper layer further when said rate of a data loss is larger than a threshold [smaller than a predetermined threshold] predetermined in the ratio of said transmitting rate and said receive rate is received. The data sequence for correction received when said rate of a data loss is smaller than a threshold [smaller than a predetermined threshold] predetermined in the ratio of said transmitting rate and said receive rate is reduced. When said rate of a data loss is larger than a larger threshold predetermined in the ratio of said transmitting rate and said receive rate than a predetermined threshold, the data sequence for correction is received further. It is the data communication approach according to claim 38 characterized by reducing the extended sequence received when said rate of a data loss is smaller than a larger threshold predetermined in the ratio of said transmitting rate and said receive rate than a predetermined threshold sequentially from the upper layer.

[Claim 40] The data communication approach according to claim 37 characterized by acquiring the rate of a data loss as said receive state at said condition acquisition step.

[Claim 41] When said rate of a data loss is receiving the data sequence smaller than a predetermined threshold for said error corrections at said selection step Reduce the received data sequence for error corrections, and the extended sequence which is a data sequence of the coded data of the upper layer further is received. When said rate of a data loss has not received the data sequence smaller than a predetermined threshold for said error corrections Furthermore, when the extended sequence which is a data sequence of the coded data of the upper layer is received and said rate of a data loss is receiving an extended sequence more greatly than a predetermined threshold It is the data communication approach according to claim 40 characterized by receiving the data sequence for said error corrections further when the received extended sequence is reduced, the data sequence for said error corrections is received further and said rate of a data loss has not received the extended sequence more greatly than a predetermined threshold.

[Claim 42] Said predetermined threshold is the data communication approach according to claim 39 or 41 characterized by what it opts for according to the coding method of said coded data.

[Claim 43] The data communication approach given in claim 31 thru/or any of 42 they are. [which is characterized by the ability to apply to the multicast communication link which carries out the multiple address of the data, such as a dynamic image, to the data communication unit of two or more receiving sides through networks, such as the Internet, from the data communication unit of said transmitting side]

[Claim 44] It is the storage in which read-out [computer / which memorized the program which performs the data communication approach applied to the data telecommunication system which transmits and receives data through a network between the data communication unit of a transmitting side and the data communication unit of two or more receiving sides] is possible. The coding step which said data communication approach encodes said data hierarchical, and generates coded data, The data generation step for correction which generates the data for error corrections to each coded data encoded hierarchical at this coding step, The transmitting step controlled to transmit said coded data encoded hierarchical and data for said error corrections as a respectively different data sequence, The storage characterized by having the selection step which chooses a suitable data sequence based on a receive state from said respectively different data sequences, and the receiving step controlled to receive the data sequence chosen at this selection step.

[Claim 45] The data sequence which carries out a transmission control at said transmitting step is a storage according to claim 44 characterized by being the fundamental series according to the hierarchy of coding of said data, one or more extended sequences which are the upper layer of these fundamental series, and a data sequence for correction according to each data for correction generated to said data encoded hierarchical.

[Claim 46] Said fundamental series are storages according to claim 45 characterized by surely being chosen from said data sequences in said selection step.

[Claim 47] Furthermore, the data packet-ized step which packet-izes the coded data encoded hierarchical at said coding step, and generates a data packet, It has the data packet-ized step for correction which generates the packet for error corrections using the data for said error

corrections. At said data generation step for correction The data for said error corrections are generated using said data packet. At said transmitting step The storage according to claim 44 characterized by controlling to transmit said data packet and said packet for error corrections as the data sequence of said coded data, and a data sequence of the data for said error corrections, respectively.

[Claim 48] The storage according to claim 47 characterized by controlling by said transmitting step to add data transmitting time information and the sequence number, and to transmit for every data packet within said data sequence.

[Claim 49] The storage according to claim 47 characterized by generating the data for said error corrections only using the coded data part of this data packet with reference to the data packet of said data encoded hierarchical, generating the payload header which includes only information indispensable at the time of an error correction at said data packet-ized step for correction, and generating said packet for error corrections at said data generation step for correction using the data and said payload header for said error corrections.

[Claim 50] Furthermore, the storage according to claim 44 characterized by having the condition acquisition step which acquires said receive state.

[Claim 51] The storage according to claim 50 characterized by acquiring the rate of a data loss, a transmitting rate, and a receive rate as said receive state at said condition acquisition step.

[Claim 52] It controls by said selection step to receive the extended sequence which is a data sequence of the coded data of the upper layer further when said rate of a data loss is larger than a threshold [smaller than a predetermined threshold] predetermined in the ratio of said transmitting rate and said receive rate. The data sequence for correction received when said rate of a data loss is smaller than a threshold [smaller than a predetermined threshold] predetermined in the ratio of said transmitting rate and said receive rate is reduced. It controls to receive the data sequence for correction further, when said rate of a data loss is larger than a larger threshold predetermined in the ratio of said transmitting rate and said receive rate than a predetermined threshold. It is the storage according to claim 51 characterized by reducing the extended sequence received when said rate of a data loss is smaller than a larger threshold predetermined in the ratio of said transmitting rate and said receive rate than a predetermined threshold sequentially from the upper layer.

[Claim 53] The storage according to claim 50 characterized by acquiring the rate of a data loss as said receive state at said condition acquisition step.

[Claim 54] When said rate of a data loss is receiving the data sequence smaller than a predetermined threshold for said error corrections at said selection step It controls to reduce the received data sequence for error corrections, and to receive the extended sequence which is a data sequence of the coded data of the upper layer further. When said rate of a data loss has not received the data sequence smaller than a predetermined threshold for said error corrections Furthermore, when it controls to receive the extended sequence which is a data sequence of the coded data of the upper layer and said rate of a data loss is receiving an extended sequence more greatly than a predetermined threshold When it controls to reduce the received extended sequence and to receive the data sequence for said error corrections further and said rate of a data loss has not received the extended sequence more greatly than a predetermined threshold The storage according to claim 53 characterized by controlling to receive the data sequence for said error corrections further.

[Claim 55] Said predetermined threshold is a storage according to claim 52 or 54 characterized by what it opts for according to the coding method of said coded data.

[Claim 56] A storage given in claim 44 thru/or any of 55 they are. [which is characterized by the ability to apply to the multicast communication link which carries out the multiple address of the data, such as a dynamic image, to the data communication unit of two or more receiving sides through networks, such as the Internet, from the data communication unit of said transmitting side]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] About a data telecommunication system, a data communication unit, the data communication approach, and a storage, in more detail, this invention relates data generated regularly, such as an image and voice, to a suitable data telecommunication system, a data communication unit, the data communication approach, and a storage, when performing real time transmission/reception through a network.
[0002]
[Description of the Prior Art] Generally, when performing data communication in quality the network of not guaranteeing like the Internet, the data loss by the error produced in the network is not avoided. especially -- difference, such as H.263 (international standards of a full color dynamic-image coding method), and MPEG (Moving Picture Experts Group: full color dynamic-image compression method), -- when transmitting the dynamic image compressed by the codec, in order to spread the effect of a data loss also in the space of an image, and the direction of time amount, it has been a technical problem with the important correspondence to an error as a problem different from control of a transmitting rate.
[0003] As a means for restoring this data loss, the technique of Forward Error Correction (FEC: automatic error correction method) is considered. This transmits beforehand the data (FEC data) for performing an error correction to redundancy, when an error actually occurs in a network, it restores the data lost using this FEC data, and it is considered to be suitable for the communication link [real time / dynamic image / especially] in that the time delay which error restoration takes compared with the method which performs resending of loss data etc. can be suppressed comparatively low. As directions of FEC, Internet Draft (An RTP Payload Format for Generic Forward Error Correction) by IETF (Internet Engineering Task Force: Internet special technical investigating committee) is proposed.
[0004] In this case, how many the amounts of data of FEC are added changes with network situations. Then, the technique of adjusting the redundant amount of data for FEC is devised according to the network situation. Even if many terminals exist, such a technique is made on the assumption that it says [one kind of / which carried out data / transmit]. However, under the situation that many accepting stations exist, to adjust the error correction amount of data the optimal for every accepting station is desired.
[0005]
[Problem(s) to be Solved by the Invention] On the other hand, when transmitting continuation media called image voice to two or more accepting stations through a network at coincidence on real time, the quality of the media which transmit poses a problem. When especially the network environments of each accepting station differ, the problem whether quality media should be transmitted according to the terminal connected in the network of a broadband or quality should be adjusted to a terminal without the capacity which only the media of low quality can receive arises. Then, it hierarchizes, media data are compressed and the technique of transmitting each hierarchy by another stream is proposed. Even if only a basic hierarchy receives, the data of minimum quality can be received, and the media of high quality can be gradually received now by

joining the data stream (data sequence) of the upper layer one by one, and receiving to it more.
[0006] Thus, the accepting station with the narrow effective band during transmission and reception receives only the stream of a basic lower layer, minimum quality is acquired, the accepting station with the network of a broadband is received to the stream of the high order layer which can reproduce quality media, and the technique quality media are obtained is devised. By such technique, the data with which quality differs variously can be transmitted to two or more accepting stations accommodative. Furthermore, in order to correspond to the network where the dependability of a transmission line differs, it is desirable to also adjust the amount of addition of error correction data according to the network situation for every accepting station.
[0007] By the way, in the network where the networks (Ethernet (LAN of the bus structure which U.S. Xerox, DEC, and three companies of Intel developed jointly), ISDN (Integrated Service Digital Network: Comprehensive Digital Network), modem, etc.) of a different communication mode like the Internet are intermingled on the way, and various data flow into an intermediate node, a multiple address system like a multicast (method which transmits the same data to two or more terminals by one packet) is spreading. In such a situation, when transmitting continuation media called image voice to many accepting stations on real time at coincidence, according to the topology of the network for every accepting station, the amount of external traffic, etc., it is necessary to realize the data transmitting method for having taken into consideration the optimal quality and the optimal error resistance.
[0008] As mentioned above, the multicast communication link which carries out the multiple address of the media data, such as a dynamic image, to many addressees through a network is beginning to spread, but when performing such a communication link, the correspondence to greatly different communication environment among addressees poses a problem. That is, if superfluous data flow into an addressee's channel connected by narrow-band width of face when transmitting at the high rate according to the addressee who has connected with sufficient bandwidth, congestion arises and transmission at a low rate is conversely performed according to a low-speed circuit, it will be a problem of the addressee of a broadband using bandwidth and stopping going out. Since this problem is coped with, in the transmitting side, two or more hierarchized transmit data sequences (data stream) are transmitted, and the approach of choosing only a suitable sequence and receiving out of these data sequence, by the addressee side, is proposed. The addressee who the addressee who can use a broadband receives the sequence of a high rate or a large number by this, and is connected by the narrow-band line can realize the communication link by the receive rate with each respectively suitable addressee by receiving only the sequence of a low rate or a fraction.
[0009] By the way, when the communication environment between addressees differs greatly like a multicast, the generating situations of an error also differ for every addressee, therefore it is necessary [for an addressee to be also able to choose extent of not only a receive rate but the error resistance guaranteed according to communication environment] in order to realize good communication link quality.
[0010] When it be make in view of the point mentioned above and perform data communication to much addressees and coincidence through a network , by choose the receive rate and the error resistance to which each addressee be suitable for each receiving environment , this invention realize good communication link quality , and aim at offer the data telecommunication system which enabled distribution of real time animation media especially in the multicast environment , a data communication unit , the data communication approach , and a storage .
[0011]
[Means for Solving the Problem] In order to attain the above-mentioned purpose, invention according to claim 1 It is the data telecommunication system which transmits and receives data through a network between the data communication unit of a transmitting side, and the data communication unit of two or more receiving sides. The data communication unit of said transmitting side A coding means to encode said data hierarchical and to generate coded data, A data generation means for correction to generate the data for error corrections to each coded data encoded hierarchical with this coding means, It has a transmitting means to transmit said coded data encoded hierarchical and data for said error corrections as a respectively different

data sequence. The data communication unit of said receiving side It is characterized by having a selection means to choose a suitable data sequence based on a receive state from said respectively different data sequences, and a receiving means to receive the data sequence chosen with this selection means.

[0012] In order to attain the above-mentioned purpose, invention according to claim 2 is characterized by the data sequences transmitted with said transmitting means being the fundamental series according to the hierarchy of coding of said data, one or more extended sequences which are the upper layer of these fundamental series, and a data sequence for correction according to each data for correction generated to said data encoded hierarchical.

[0013] In order to attain the above-mentioned purpose, invention according to claim 3 is characterized by surely choosing said fundamental series from said data sequences by said selection means.

[0014] In order to attain the above-mentioned purpose, invention according to claim 4 Furthermore, a data packet-ized means for the data communication unit of said transmitting side to packet-ize the coded data encoded hierarchical with said coding means, and to generate a data packet, It has a data packet-ized means for correction to generate the packet for error corrections using the data for said error corrections. Said data generation means for correction The data for said error corrections are generated using said data packet, and said transmitting means is characterized by transmitting said data packet and said packet for error corrections as the data sequence of said coded data, and a data sequence of the data for said error corrections, respectively.

[0015] In order to attain the above-mentioned purpose, it is characterized by for said transmitting means adding data transmitting time information and the sequence number, and invention according to claim 5 transmitting it for every data packet within said data sequence.

[0016] In order to attain the above-mentioned purpose, invention according to claim 6 Said data generation means for correction generates the data for said error corrections only using the coded data part of this data packet with reference to the data packet of said data encoded hierarchical. Said data packet-ized means for correction is characterized by generating a payload header only including information indispensable at the time of an error correction, and generating said packet for error corrections using the data and said payload header for said error corrections.

[0017] In order to attain the above-mentioned purpose, it is characterized by invention according to claim 7 having a condition acquisition means by which the data communication unit of said receiving side acquires said receive state further.

[0018] In order to attain the above-mentioned purpose, invention according to claim 8 is characterized by said condition acquisition means acquiring the rate of a data loss, a transmitting rate, and a receive rate as said receive state.

[0019] In order to attain the above-mentioned purpose, invention according to claim 9 The extended sequence which is a data sequence of the coded data of the upper layer further when said rate of a data loss of said selection means is larger than a threshold [smaller than a predetermined threshold] predetermined in the ratio of said transmitting rate and said receive rate is received. The data sequence for correction received when said rate of a data loss is smaller than a threshold [smaller than a predetermined threshold] predetermined in the ratio of said transmitting rate and said receive rate is reduced. When said rate of a data loss is larger than a larger threshold predetermined in the ratio of said transmitting rate and said receive rate than a predetermined threshold, the data sequence for correction is received further. When said rate of a data loss is smaller than a larger threshold predetermined in the ratio of said transmitting rate and said receive rate than a predetermined threshold, it is characterized by reducing the extended sequence to receive sequentially from the upper layer.

[0020] In order to attain the above-mentioned purpose, invention according to claim 10 is characterized by said condition acquisition means acquiring the rate of a data loss as said receive state.

[0021] In order to attain the above-mentioned purpose, invention according to claim 11 When said rate of a data loss is receiving the data sequence smaller than a predetermined threshold

for said error corrections, said selection means Reduce the received data sequence for error corrections, and the extended sequence which is a data sequence of the coded data of the upper layer further is received. When said rate of a data loss has not received the data sequence smaller than a predetermined threshold for said error corrections Furthermore, when the extended sequence which is a data sequence of the coded data of the upper layer is received and said rate of a data loss is receiving an extended sequence more greatly than a predetermined threshold When the received extended sequence is reduced, the data sequence for said error corrections is received further and said rate of a data loss has not received the extended sequence more greatly than a predetermined threshold, it is characterized by receiving the data sequence for said error corrections further.

[0022] In order to attain the above-mentioned purpose, invention according to claim 12 is characterized by determining said predetermined threshold according to the coding method of said coded data.

[0023] In order to attain the above-mentioned purpose, invention according to claim 13 is characterized by the ability to apply to the multicast communication link which carries out the multiple address of the data, such as a dynamic image, to the data communication unit of two or more receiving sides through networks, such as the Internet, from the data communication unit of said transmitting side.

[0024] In order to attain the above-mentioned purpose, invention according to claim 14 A coding means to be the data communication unit which transmits data through a network to the data communication unit of two or more receiving sides, and to encode said data hierarchical and to generate coded data, A data generation means for correction to generate the data for error corrections to each coded data encoded hierarchical with this coding means, It is characterized by having a transmitting means to transmit said coded data encoded hierarchical and data for said error corrections as a respectively different data sequence.

[0025] In order to attain the above-mentioned purpose, invention according to claim 15 is characterized by the data sequences transmitted with said transmitting means being the fundamental series according to the hierarchy of coding of said data, one or more extended sequences which are the upper layer of these fundamental series, and a data sequence for correction according to each data for correction generated to said data encoded hierarchical.

[0026] In order to attain the above-mentioned purpose, invention according to claim 16 is characterized by surely choosing said fundamental series from said data sequences by the data communication unit of said receiving side.

[0027] In order to attain the above-mentioned purpose, invention according to claim 17 Furthermore, a data packet-ized means to packet-ize the coded data encoded hierarchical with said coding means, and to generate a data packet, It has a data packet-ized means for correction to generate the packet for error corrections using the data for said error corrections. Said data generation means for correction The data for said error corrections are generated using said data packet, and said transmitting means is characterized by transmitting said data packet and said packet for error corrections as the data sequence of said coded data, and a data sequence of the data for said error corrections, respectively.

[0028] In order to attain the above-mentioned purpose, it is characterized by for said transmitting means adding data transmitting time information and the sequence number, and invention according to claim 18 transmitting it for every data packet within said data sequence.

[0029] In order to attain the above-mentioned purpose, invention according to claim 19 Said data generation means for correction generates the data for said error corrections only using the coded data part of this data packet with reference to the data packet of said data encoded hierarchical. Said data packet-ized means for correction is characterized by generating a payload header only including information indispensable at the time of an error correction, and generating said packet for error corrections using the data and said payload header for said error corrections.

[0030] In order to attain the above-mentioned purpose, invention according to claim 20 is characterized by the ability to apply to the multicast communication link which carries out the multiple address of the data, such as a dynamic image, to the data communication unit of two or

more receiving sides through networks, such as the Internet.
[0031] In order to attain the above-mentioned purpose, invention according to claim 21 is a data communication unit which receives data through a network from the data communication unit of a transmitting side, and is characterized by having a selection means to choose a suitable data sequence based on a receive state from the data sequences transmitted from the data communication unit of said transmitting side, and a receiving means to receive the data sequence chosen with this selection means.
[0032] In order to attain the above-mentioned purpose, invention according to claim 22 is characterized by the data sequences transmitted from the data communication unit of said transmitting side being the fundamental series according to the hierarchy of coding of said data, one or more extended sequences which are the upper layer of these fundamental series, and a data sequence for correction according to each data for correction generated to said data encoded hierarchical.
[0033] In order to attain the above-mentioned purpose, invention according to claim 23 is characterized by surely choosing said fundamental series from said data sequences by said selection means.
[0034] In order to attain the above-mentioned purpose, invention according to claim 24 is characterized by having further a condition acquisition means to acquire said receive state.
[0035] In order to attain the above-mentioned purpose, invention according to claim 25 is characterized by said condition acquisition means acquiring the rate of a data loss, a transmitting rate, and a receive rate as said receive state.
[0036] In order to attain the above-mentioned purpose, invention according to claim 26 The extended sequence which is a data sequence of the coded data of the upper layer further when said rate of a data loss of said selection means is larger than a threshold [smaller than a predetermined threshold] predetermined in the ratio of said transmitting rate and said receive rate is received. The data sequence for correction received when said rate of a data loss is smaller than a threshold [smaller than a predetermined threshold] predetermined in the ratio of said transmitting rate and said receive rate is reduced. When said rate of a data loss is larger than a larger threshold predetermined in the ratio of said transmitting rate and said receive rate than a predetermined threshold, the data sequence for correction is received further. When said rate of a data loss is smaller than a larger threshold predetermined in the ratio of said transmitting rate and said receive rate than a predetermined threshold, it is characterized by reducing the extended sequence to receive sequentially from the upper layer.
[0037] In order to attain the above-mentioned purpose, invention according to claim 27 is characterized by said condition acquisition means acquiring the rate of a data loss as said receive state.
[0038] In order to attain the above-mentioned purpose, invention according to claim 28 When said rate of a data loss is receiving the data sequence smaller than a predetermined threshold for said error corrections, said selection means Reduce the received data sequence for error corrections, and the extended sequence which is a data sequence of the coded data of the upper layer further is received. When said rate of a data loss has not received the data sequence smaller than a predetermined threshold for said error corrections Furthermore, when the extended sequence which is a data sequence of the coded data of the upper layer is received and said rate of a data loss is receiving an extended sequence more greatly than a predetermined threshold When the received extended sequence is reduced, the data sequence for said error corrections is received further and said rate of a data loss has not received the extended sequence more greatly than a predetermined threshold, it is characterized by receiving the data sequence for said error corrections further.
[0039] In order to attain the above-mentioned purpose, invention according to claim 29 is characterized by determining said predetermined threshold according to the coding method of said coded data.
[0040] In order to attain the above-mentioned purpose, invention according to claim 30 is characterized by the ability to apply to the multicast communication link to which the multiple address of the data, such as a dynamic image, is carried out through networks, such as the

Internet, from the data communication unit of said transmitting side.
[0041] In order to attain the above-mentioned purpose, invention according to claim 31 It is the data communication approach applied to the data telecommunication system which transmits and receives data through a network between the data communication unit of a transmitting side, and the data communication unit of two or more receiving sides. The coding step which the data communication unit of said transmitting side encodes said data hierarchical, and generates coded data, The data generation step for correction which generates the data for error corrections to each coded data encoded hierarchical at this coding step, It has the transmitting step which transmits said coded data encoded hierarchical and data for said error corrections as a respectively different data sequence. The data communication unit of said receiving side It is characterized by having the selection step which chooses a suitable data sequence based on a receive state from said respectively different data sequences, and the receiving step which receives the data sequence chosen at this selection step.
[0042] In order to attain the above-mentioned purpose, invention according to claim 32 is characterized by the data sequences transmitted at said transmitting step being the fundamental series according to the hierarchy of coding of said data, one or more extended sequences which are the upper layer of these fundamental series, and a data sequence for correction according to each data for correction generated to said data encoded hierarchical.
[0043] In order to attain the above-mentioned purpose, invention according to claim 33 is characterized by surely choosing said fundamental series from said data sequences in said selection step. In order to attain the above-mentioned purpose, invention according to claim 34 Furthermore, the data packet-ized step which the data communication unit of said transmitting side packet-izes the coded data encoded hierarchical at said coding step, and generates a data packet, It has the data packet-ized step for correction which generates the packet for error corrections using the data for said error corrections. At said data generation step for correction The data for said error corrections are generated using said data packet, and it is characterized by transmitting said data packet and said packet for error corrections as the data sequence of said coded data, and a data sequence of the data for said error corrections, respectively at said transmitting step.
[0044] In order to attain the above-mentioned purpose, invention according to claim 35 is characterized by adding data transmitting time information and the sequence number, and transmitting for every data packet within said data sequence, at said transmitting step.
[0045] In order to attain the above-mentioned purpose, invention according to claim 36 At said data generation step for correction, the data for said error corrections are generated only using the coded data part of this data packet with reference to the data packet of said data encoded hierarchical. At said data packet-ized step for correction, it is characterized by generating a payload header only including information indispensable at the time of an error correction, and generating said packet for error corrections using the data and said payload header for said error corrections.
[0046] In order to attain the above-mentioned purpose, it is characterized by invention according to claim 37 having the condition acquisition step from which the data communication unit of said receiving side acquires said receive state further.
[0047] In order to attain the above-mentioned purpose, invention according to claim 38 is characterized by acquiring the rate of a data loss, a transmitting rate, and a receive rate as said receive state at said condition acquisition step.
[0048] In order to attain the above-mentioned purpose, invention according to claim 39 At said selection step, the extended sequence which is a data sequence of the coded data of the upper layer further when said rate of a data loss is larger than a threshold [smaller than a predetermined threshold] predetermined in the ratio of said transmitting rate and said receive rate is received. The data sequence for correction received when said rate of a data loss is smaller than a threshold [smaller than a predetermined threshold] predetermined in the ratio of said transmitting rate and said receive rate is reduced. When said rate of a data loss is larger than a larger threshold predetermined in the ratio of said transmitting rate and said receive rate than a predetermined threshold, the data sequence for correction is received further. When said

rate of a data loss is smaller than a larger threshold predetermined in the ratio of said transmitting rate and said receive rate than a predetermined threshold, it is characterized by reducing the extended sequence to receive sequentially from the upper layer.
[0049] In order to attain the above-mentioned purpose, invention according to claim 40 is characterized by acquiring the rate of a data loss as said receive state at said condition acquisition step.
[0050] In order to attain the above-mentioned purpose, invention according to claim 41 When said rate of a data loss is receiving the data sequence smaller than a predetermined threshold for said error corrections at said selection step Reduce the received data sequence for error corrections, and the extended sequence which is a data sequence of the coded data of the upper layer further is received. When said rate of a data loss has not received the data sequence smaller than a predetermined threshold for said error corrections Furthermore, when the extended sequence which is a data sequence of the coded data of the upper layer is received and said rate of a data loss is receiving an extended sequence more greatly than a predetermined threshold When the received extended sequence is reduced, the data sequence for said error corrections is received further and said rate of a data loss has not received the extended sequence more greatly than a predetermined threshold, it is characterized by receiving the data sequence for said error corrections further.
[0051] In order to attain the above-mentioned purpose, invention according to claim 42 is characterized by determining said predetermined threshold according to the coding method of said coded data.
[0052] In order to attain the above-mentioned purpose, invention according to claim 43 is characterized by the ability to apply to the multicast communication link which carries out the multiple address of the data, such as a dynamic image, to the data communication unit of two or more receiving sides through networks, such as the Internet, from the data communication unit of said transmitting side.
[0053] In order to attain the above-mentioned purpose, invention according to claim 44 It is the storage in which read-out [computer / which memorized the program which performs the data communication approach applied to the data telecommunication system which transmits and receives data through a network between the data communication unit of a transmitting side and the data communication unit of two or more receiving sides] is possible. The coding step which said data communication approach encodes said data hierarchical, and generates coded data, The data generation step for correction which generates the data for error corrections to each coded data encoded hierarchical at this coding step, The transmitting step controlled to transmit said coded data encoded hierarchical and data for said error corrections as a respectively different data sequence, It is characterized by having the selection step which chooses a suitable data sequence based on a receive state from said respectively different data sequences, and the receiving step controlled to receive the data sequence chosen at this selection step.
[0054] In order to attain the above-mentioned purpose, invention according to claim 45 is characterized by the data sequences which carry out a transmission control at said transmitting step being the fundamental series according to the hierarchy of coding of said data, one or more extended sequences which are the upper layer of these fundamental series, and a data sequence for correction according to each data for correction generated to said data encoded hierarchical.

[0055] In order to attain the above-mentioned purpose, invention according to claim 46 is characterized by surely choosing said fundamental series from said data sequences in said selection step.
[0056] In order to attain the above-mentioned purpose, invention according to claim 47 Furthermore, the data packet-ized step which packet-izes the coded data encoded hierarchical at said coding step, and generates a data packet, It has the data packet-ized step for correction which generates the packet for error corrections using the data for said error corrections. At said data generation step for correction The data for said error corrections are generated using said data packet. At said transmitting step It is characterized by controlling to transmit said data packet and said packet for error corrections as the data sequence of said coded data, and a

data sequence of the data for said error corrections, respectively.
[0057] In order to attain the above-mentioned purpose, invention according to claim 48 is characterized by controlling by said transmitting step to add data transmitting time information and the sequence number, and to transmit for every data packet within said data sequence.
[0058] In order to attain the above-mentioned purpose, invention according to claim 49 At said data generation step for correction, the data for said error corrections are generated only using the coded data part of this data packet with reference to the data packet of said data encoded hierarchical. At said data packet-ized step for correction, it is characterized by generating a payload header only including information indispensable at the time of an error correction, and generating said packet for error corrections using the data and said payload header for said error corrections.
[0059] In order to attain the above-mentioned purpose, invention according to claim 50 is characterized by having further the condition acquisition step which acquires said receive state.
[0060] In order to attain the above-mentioned purpose, invention according to claim 51 is characterized by acquiring the rate of a data loss, a transmitting rate, and a receive rate as said receive state at said condition acquisition step.
[0061] In order to attain the above-mentioned purpose, invention according to claim 52 It controls by said selection step to receive the extended sequence which is a data sequence of the coded data of the upper layer further when said rate of a data loss is larger than a threshold [smaller than a predetermined threshold] predetermined in the ratio of said transmitting rate and said receive rate. The data sequence for correction received when said rate of a data loss is smaller than a threshold [smaller than a predetermined threshold] predetermined in the ratio of said transmitting rate and said receive rate is reduced. It controls to receive the data sequence for correction further, when said rate of a data loss is larger than a larger threshold predetermined in the ratio of said transmitting rate and said receive rate than a predetermined threshold. When said rate of a data loss is smaller than a larger threshold predetermined in the ratio of said transmitting rate and said receive rate than a predetermined threshold, it is characterized by reducing the extended sequence to receive sequentially from the upper layer.
[0062] In order to attain the above-mentioned purpose, invention according to claim 53 is characterized by acquiring the rate of a data loss as said receive state at said condition acquisition step.
[0063] In order to attain the above-mentioned purpose, invention according to claim 54 When said rate of a data loss is receiving the data sequence smaller than a predetermined threshold for said error corrections at said selection step It controls to reduce the received data sequence for error corrections, and to receive the extended sequence which is a data sequence of the coded data of the upper layer further. When said rate of a data loss has not received the data sequence smaller than a predetermined threshold for said error corrections Furthermore, when it controls to receive the extended sequence which is a data sequence of the coded data of the upper layer and said rate of a data loss is receiving an extended sequence more greatly than a predetermined threshold When it controls to reduce the received extended sequence and to receive the data sequence for said error corrections further and said rate of a data loss has not received the extended sequence more greatly than a predetermined threshold, it is characterized by controlling to receive the data sequence for said error corrections further.
[0064] In order to attain the above-mentioned purpose, invention according to claim 55 is characterized by determining said predetermined threshold according to the coding method of said coded data.
[0065] In order to attain the above-mentioned purpose, invention according to claim 56 is characterized by the ability to apply to the multicast communication link which carries out the multiple address of the data, such as a dynamic image, to the data communication unit of two or more receiving sides through networks, such as the Internet, from the data communication unit of said transmitting side.
[0066]
[Embodiment of the Invention] Hereafter, the gestalt of the 2nd operation is explained to the gestalt list of operation of the 1st of this invention at a detail based on a drawing.

[0067] [Gestalt of the 1st operation] drawing 1 is the block diagram showing the configuration of the data communication unit concerning the gestalt of operation of the 1st of this invention. As for the data communication unit concerning the gestalt of operation of the 1st of this invention, a transmit terminal 1-1, and two or more accepting stations 1-21 and 1-22 -- are constituted possible [a communication link] through the network 1-3. Drawing 1 shows the internal configuration and connection relation of each terminal in the case of receiving the data which a transmit terminal 1-1 transmits by the accepting station 1-21 and 1-22 -- through a network 1-3.

[0068] Furthermore, the above-mentioned transmit terminal 1-1 is equipped with the data generation section 1-11, the layer 1 transmitting section (BaseLayer1) 1-121, the layer 2 transmitting section (FECLayer1) 1-122, the layer 3 transmitting section (Enhancement Layer 2) 1-123, the layer-4 transmitting section (FEC Layer 2) 1-124, and the layer 5 transmitting section (Enhancement Layer 3) 1-125. Furthermore, the above-mentioned accepting station 1-21 is equipped with the data receive section 1-211, the data-processing section 1-212, the receiving layer selection section 1-213, and the receiving status monitor section 1-124. In addition, other accepting-station 1-22 -- omits illustration like the above-mentioned accepting station 1-21 for a configuration.

[0069] Here, it does not contain to a large-scale thing which many and unspecified networks [like LAN (Local Area Network) currently managed by the in-house to the so-called Internet] whose network 1-3 in the gestalt of operation of the 1st of this invention is combined, and does not specify about the gestalt.

[0070] Although the image data by which the capture was specifically carried out with the video camera as data which a transmit terminal 1-1 transmits can be considered if the above-mentioned configuration is explained in full detail with actuation, as contents of data, it does not restrict to an image. In a transmit terminal 1-1, the data generation section 1-11 encodes the media which transmit hierarchical. Since hierarchy coding is used, although it is of inferior quality when it reappears only by the Base layer (fundamental series), media are reproducible at worst. The Enhancement layer (extended sequence) of a high order is combining with a Base layer and using, and can reproduce media in high quality more. For example, resolution serves as a high, high image of a frame rate in case of the case of an image. The data by which hierarchy coding was carried out are packet-ized for transmission, and the FEC data for an error correction are generated about each hierarchy based on the packet-ized data. A parity packet etc. shall be used as FEC data.

[0071] A Base layer, each Enhancement layer, and the error correction layer to each are sent to another layer transmitting section (data transmitting section) 1-121 to 1-125 as a respectively different stream. The layer transmitting section (data transmitting section) 1-121 to 1-125 adds the information on time of day that a sequence number and data are transmitted for every packet, sends out each layer to a network 1-3 as another stream, and carries out a multicast (distribute the same information to two or more specific destinations) to it. It shall be chosen by the accepting station 1-21 and 1-22 -- which layer is received.

[0072] On the other hand, each accepting station 1-21 and 1-22 -- receive only a suitable thing among each layer transmitted. The received data are sent to the data-processing section 1-212, and are processed. For example, when data are an image, processings (a decryption, display process, etc.) for displaying an image are performed in the data-processing section 1-212. In each accepting station 1-21 and 1-22 --, during data reception, the receiving status monitor section 1-214 carries out the monitor of the receiving situations, such as a packet loss and a transit delay, and sends the information to the receiving layer selection section 1-213. The receiving layer selection section 1-213 determines the layer which should receive according to the sent receiving situation. It reports that the receiving layer selection section 1-213 receives about the determined layer to the data receive section 1-211, and the data receive section 1-211 continues receiving the specified layer.

[0073] Next, the transmit terminal 1-1 of the data communication unit concerning the gestalt of operation of the 1st of this invention constituted like the above and each accepting station 1-21, 1-22 -- It explains referring to drawing 2 - drawing 4 </A> about actuation. The flow chart

which shows the data transmitting processing by the side of the transmit terminal of the data communication unit which drawing 2 requires for the gestalt of operation of the 1st of this invention, the flow chart which shows the data reception by the side of the accepting station of the data communication unit which drawing 3 requires for the gestalt of operation of the 1st of this invention, and drawing 4 are the accepting station 1-21 of the data communication unit concerning the gestalt of operation of the 1st of this invention, and a flow chart which shows the receiving layer selection processing in 1-22 --.

[0074] First, actuation of the transmit terminal 1-1 of a data communication unit is explained based on the flow chart of drawing 2 .

[0075] First, in a transmit terminal 1-1, the data which should be transmitted are incorporated (step S201) and hierarchy coding of the data is carried out (step S202). With a hierarchy coding technique, most, based on a low-ranking Base layer, it shall compress by adding an Enhancement layer one by one from low order, so that quality improves gradually. Each hierarchy's data are packet-ized and the stream of a Base layer and the stream of each Enhancement layer are generated (step S203). For example, when it encodes to three hierarchies, two-layer generation of the stream of one layer and an Enhancement layer will be carried out for the stream of a Base layer.

[0076] And with reference to a data packet, the packet for an error correction is generated about each hierarchy's data, and one stream of data streams of a FEC layer is generated at a time about each hierarchy (step S204). A parity packet etc. may be used for an error correction. Thus, with the media data and FEC data which were hierarchized, the layer of a data stream is generated and it is sent out on a network 1-3 as a respectively different data stream (step S205). In case data are sent out to a network 1-3 (step S205), the sequence number managed the whole stream and the information on the time stump of transmitting time of day are given to a packet.

[0077] Next, each accepting station 1-21 of the data communication unit concerning the gestalt of operation of the 1st of this invention, 1-22 -- Actuation is explained based on the flow chart of drawing 3 .

[0078] In each accepting station 1-21 and 1-22 --, the data transmitted through a network 1-3 from the transmit terminal 1-1 are received in the data receive section 1-211 (step S301). The data sent from the transmit terminal 1-1 are processed in the data-processing section 1-212 (step S302). The display of an image etc. is performed when for example, image data have been sent from the transmit terminal 1-1.

[0079] Each accepting station 1-21 and 1-22 -- are one side, and carry out the monitor of the statistical information of a transceiver situation periodically (step S303). As a transceiver situation at this time, the rate of a packet loss, a transmitting rate, a receive rate, etc. are mentioned. Although the rate of a packet loss is missing among the sequence numbers given to the transmit data, it is measurable from a number. A transmitting rate can be guessed from the time stump and sequence number which were given to the transmit data. Moreover, a receive rate is easily calculable with the packet size of received data, and the log of time of day. And the layer of the data which the accepting station should receive is chosen from the transceiver situation (step S304). When a receiving layer has modification by selection, the layer which actually receives is changed (step S305), and reception of data is continued after modification about the data of the layer which will receive.

[0080] Next, the receiving layer selection processing in the accepting station 1-21 of the data communication unit concerning the gestalt of operation of the 1st of this invention and 1-22 -- is explained based on the flow chart of drawing 4 .

[0081] First, the rate of a packet loss is investigated and the ratio of the receive rate to a transmitting rate is compared with a threshold (for example, 0.9) below as compared with a threshold (for example, 5%) (step S401) (step S402). The rate of a loss is smaller than a threshold, and when a transceiver rate ratio is larger than a threshold, since I hear that there are also few losses, the Enhancement layer of the upper layer shall be further received by allowances being in a band (step S403). Although the rate of a loss is smaller than a threshold, and it is thought that there are few losses and the quality of a channel is good when a

transceiver rate ratio is also smaller than a threshold, what transmitted cannot fully be received but it is thought that there is only no bandwidth which fully receives the amount of data transmitted. In this case, since it is not necessary to receive a redundant FEC layer vainly, the FEC layer which has received is reduced (step S404).

[0082] Since it is thought that there is no dependability in a channel, it is newly begun for the rate of a loss to be larger than a threshold, for the bandwidth of a network 1-3 to be enough when a transceiver rate ratio is sufficiently larger than a threshold, but to receive a FEC layer (step S406). On the other hand, since it is thought that the rate of a loss is larger than a threshold, and bandwidth is fundamentally insufficient when a transceiver rate ratio is smaller than a threshold, the Enhancement layer which receives is reduced sequentially from the thing of a high order (step S407). Under the present circumstances, when the FEC layer about the Enhancement-layer-which-cancels-that reception has also received, reception of this FEC layer is also stopped.

[0083] Repeating the above steps, a transmit terminal 1-1 sends out the data stream of the data by which hierarchy coding was carried out, and two or more layers generated by FEC for an error correction on a network 1-3. In an accepting station 1-21 and 1-22 --, according to a receiving situation, the data of a layer suitable as mentioned above are chosen, and it receives.

[0084] Drawing 5 is the explanatory view showing the transceiver situation of the hierarchized data that it is realizable with the above-mentioned technique concerning the gestalt of operation of the 1st of this invention. Among drawing, the bottom is a transmitting side and is the example of the hierarchical data currently prepared by hierarchy coding and the error correction. A Base layer and two Enhancement layers are generated in this example. The FEC layer for every one-layer error correction of three layers is prepared for a total of three data streams, respectively. Only a Base stream will receive the narrow accepting station (client) of a network band like [in / A / drawing].

[0085] Although the accepting station with a network band large on the other hand to some extent (client) will receive three data streams like [for example, in / B or C / drawing], the accepting station connected by the unstable network with many packet losses receives a FEC stream like [in / B / drawing]. The accepting station connected in the network which, on the other hand, has dependability with few packet losses will not receive a FEC stream like [in / C / drawing], but will receive a media data stream to the quality top layer.

[0086] Drawing 6 is the block diagram showing the example which applied the data communication unit concerning the gestalt of operation of the 1st of this invention mentioned above to the data telecommunication system. The profile configuration of the data telecommunication system concerning the gestalt of operation of the 1st of this invention is carried out from the camera server 10 and the client 20. Furthermore, the camera server 10 is equipped with a camera 100, the capture section 101, an interface 102, CPU103, ROM104 and RAM105, external storage 106, the keyboard 107, the display 108, and the communication interface 109. Furthermore, the client 20 is equipped with CPU203, ROM204, RAM205, external storage 206, the keyboard 207, the display 208, and the communication interface 209. 300 in drawing shows a network.

[0087] If the above-mentioned configuration is explained in full detail, the camera server 10 will transmit the image data photoed with the camera 100 to a client 20 through a network 300. In correspondence with the configuration of drawing 6 , and the configuration of above-mentioned drawing 1 , the camera server 10 corresponds to a transmit terminal 1-1, and dealing with an accepting station 1-21 can understand a client 20. Furthermore, two or more these clients 20 will exist in a different location connected in the network 300.

[0088] Now, the hardware-difference between the camera server 10 and a client 20 is a difference in whether it has a camera and the capture section, and the camera server 10 and client 20 both sides can realize it with a personal computer. That is, signs 103-109 and signs 203-209 are the same configurations substantially, and each can realize them by general-purpose computer (for example, personal computer).

[0089] On the other hand, it differs in that the software (it is stored in external storage 206, and it is loaded to RAM205 and performs) which the software (it is stored in external storage 106,

and it is loaded to RAM105 and performs) for compressing the image data which carried out the capture in the camera server 10, generating the data of an error correction, and transmitting to a client 20 is operating, receives image data in a client 20, and displays it operates by software. About compression of data, although it is also possible to also carry out in hardware by the capture card and to carry out by software, it becomes the conditions for realizing the gestalt of operation of the 1st of this invention that it is compressible using a hierarchy coding technique.
[0090] However, in this example, when it divides into the camera server 10 and a client 20 for convenience, and is only shown and video capture ability is added to both sides, both sides can function as a camera server and a client.
[0091] Now, it explains, referring to the flow chart of drawing 7 - drawing 9 about the actuation in the case of applying actuation of the data communication unit of above-mentioned drawing 1 explained previously to the data telecommunication system of drawing 6. The flow chart which shows the transmitting processing in the camera server which drawing 7 requires for the gestalt of operation of the 1st of this invention, the flow chart which shows the data reception in the client which drawing 8 requires for the gestalt of operation of the 1st of this invention, and drawing 9 are flow charts which show the receiving layer modification processing in the client concerning the gestalt of operation of the 1st of this invention.
[0092] First, it explains from actuation of the camera server 10 (drawing 7). First, in the camera server 10, the image which carried out the capture from the camera 100 in the capture section 101 according to capture spacing is incorporated (step S701). Hierarchy coding of the image by which the capture was carried out in the capture section 101 is carried out at two or more hierarchies (step S702). Next, it is divided into the packet of suitable magnitude for every hierarchy (step S703). Furthermore, the parity packet for an error correction is generated about the media data of each packet-ized layer (step S704). A parity packet shall be added to one number packet of media data.
[0093] Thus, rate adjustment is carried out so that it may be enough for the following capture timing, and the data of each generated layer are transmitted on a network 300 as a respectively different data stream (step S705). The camera server 10 repeats from the capture of an image to transmission periodically as mentioned above.
[0094] On the other hand, although it is processing of a client 20, data reception (drawing 8) is explained first. First, in a client 20, the data of the receiving layer which arrived from the camera server 10 are received (step S801). When a packet loss is investigated and there is a loss in the phase at which data of one frame arrived, an error correction packet recovers (step S802). Next, the data after an error correction are decoded, an image is generated (step S803), and it displays on a display 208 (step S804).
[0095] Next, the receiving layer modification processing (drawing 9) by the client 20 is explained. First, in a client 20, an initial receiving layer is decided at the time of starting (step S811), and an initial layer change timer is set up (step S812). Next, when it confirms whether the time amount of an initial layer change timer has run out (step S813) and the time amount of an initial layer change timer has passed, the statistical information of a receiving situation is checked (step S814). Next, according to above-mentioned technique (drawing 4), a receiving layer is determined and changed from the receiving situation (step S815). Modification of this receiving layer does effect as modification of the assignment receiving layer of the above-mentioned reception. Then, a receiving layer change timer is set up again (step S816), and processing of return and the above-mentioned step S813 to the step S816 is repeated to the above-mentioned step S813.
[0096] The above result, when hierarchy coding and an error correction generate two or more streams by the transmit-terminal side and an accepting station chooses the optimal receiving data stream according to the situation of the network for every accepting station, the optimal data transfer can perform coincidence data transfer to two or more accepting stations through a network.
[0097] When the Internet is assumed as a target network with the above-mentioned operation gestalt, as a method of sending out the data to a network, IP (Internet Protocol) multicast standardized from IETF (Internet EngineeringTask Force) can be used. In this case, an accepting

station can use join to a multicast group and the message of leave which used IGMP (Internet Group Membership Protocol) as an approach of choosing the stream which receives from two or more layers.

[0098] Moreover, although it is the data rate of the Base layer of the above-mentioned operation gestalt, and an Enhancement layer, to enable it to set this up suitably according to the class of interface linked to a network class and its network is desired. For example, if the above-mentioned system is built in the company, since it will be Ethernet (Ethernet: LAN, transmission-speed:10Mbps and 100Mbps(es) of a bus structure which U.S. Xerox, DEC, and three companies of Intel developed jointly), it will be able to be set as the high transfer rate.

[0099] As explained above, according to the data communication unit concerning the gestalt of operation of the 1st of this invention While transmitting the data generation section 1-11 which encodes the data of the media for transmission hierarchical, and hierarchy-coded data as a respectively different data stream The transmit terminal 1-1 equipped with the layer transmitting section 1-121 to 1-125 which generates the data for error corrections to each data stream, and transmits as another stream respectively, Since it has the accepting station 1-21 equipped with the receiving status monitor section 1-214 which carries out the monitor of the receiving situation, the receiving layer selection section 1-213 which chooses a suitable data stream based on a receiving situation, and the data receive section 1-211 which receives the selected data stream, Following operations and effectiveness are done so. [0100] In the above-mentioned configuration, by the transmit terminal 1-1, generation of the packet for an error correction and the data stream of a FEC layer are performed about data-hierarchy coding for transmission, packet-izing of each hierarchy's data, generation of the stream of a Base layer, and the stream of each Enhancement layer, and each hierarchy's data, and it generates one stream of layers of a data stream at a time with generation, hierarchization media data, and FEC data about each hierarchy, and sends out to a network 1-3 as another data stream respectively. The sequence number managed the whole stream and the information on the time stump of transmitting time of day are given to a packet.

[0101] In an accepting station 1-21 and 1-22 --, the receiving layer based on the monitor of the statistical information of a transceiver situation, selection of the layer of data which should receive based on a transceiver situation, and receiving layer selection is changed periodically, and reception of data is continued about the data of the receiving layer after modification.

[0102] Moreover, when the rate of a loss of a packet is smaller than a threshold and a transceiver rate ratio is larger than a threshold in an accepting station 1-21 and 1-22 --, The Enhancement layer of the upper layer is received. Furthermore, when the rate of a loss is smaller than a threshold and a transceiver rate ratio also has it, [smaller than a threshold] The FEC layer which has received is reduced. When [than a threshold / that the rate of a loss is larger] a transceiver rate ratio is sufficiently larger than a threshold, A FEC layer is newly received, and when [than a threshold / that the rate of a loss is larger] a transceiver rate ratio is smaller than a threshold, the Enhancement layer which receives is reduced sequentially from the thing of a high order.

[0103] Thereby, in case data transmission is carried out to two or more accepting stations through a network in the gestalt of operation of the 1st of this invention from a transmit terminal, according to the situation of an intervening different network for every accepting station, it becomes possible to transmit data with the optimal quality and the optimal error resistance. Therefore, when you need real time nature which relays at coincidence the raw image photoed with the camera to many viewers, the outstanding effectiveness of acting effectively especially is acquired.

[0104] [Gestalt of the 2nd operation] drawing 10 is the block diagram showing the configuration of the data communication unit concerning the gestalt of operation of the 2nd of this invention. As for the data communication unit concerning the gestalt of operation of the 2nd of this invention, the transmitting-side terminal 1001 and the receiving-side terminal 1002 are constituted possible [a communication link] through the network 1021. Furthermore, the above-mentioned transmitting-side terminal 1001 is equipped with image capture equipment 1010, coding equipment 1011, the data transmitting section 1012, the FEC data generation section

1013, and the FEC data transmitting section 1014. Furthermore, the above-mentioned receiving-side terminal 1002 is equipped with the data receive section 1031, the FEC data receive section 1032, the error correction section 1033, decode equipment 1034, an image display device 1035, and the receiving sequence selection section 1036.

[0105] If the outline function of each part of the above-mentioned transmitting-side terminal 1001 and the receiving-side terminal 1002 is explained, in the transmitting-side terminal 1001, image capture equipment 1010 will capture the image of the display screen as a file. Coding equipment 1011 generates a hierarchical data sequence from the inputted video signal. The data transmitting section 1012 generates a data packet based on coded data, forms fundamental series and an extended sequence according to the hierarchy of coding, and sends them out to a network 1021. The FEC data generation section 1013 generates FEC data based on the data packet of each sequence. The FEC data transmitting section 1014 packet-izes FEC data, and sends them out to a network 1021.

[0106] On the other hand, in the receiving-side terminal 1002, the data receive section 1031 receives coded data through a network 1021. The FEC data receive section 1032 receives FEC data through a network 1021. The error correction section 1033 performs restoration processing of a loss packet. Decode equipment 1034 decodes coded data. An image display device 1035 displays the received image. The receiving sequence selection section 1036 changes a receiving sequence with a fixed time interval based on the information on a packet loss.

[0107] Furthermore, the function of the important section of the above-mentioned transmitting-side terminal 1001 and the receiving-side terminal 1002 is explained in full detail with actuation. First, the function and actuation of the transmitting-side terminal 1001 are explained. Coding equipment 1011 generates a hierarchical data sequence from the inputted video signal. Although the approach one encoder outputs two or more coded data from which resolution and an SN ratio differ about a hierarchy target's approach, the approach of outputting the coding sequence from which a frame rate differs using two or more encoders, etc. can be used, it does not specify about the approach here. It is sent to the data transmitting section 1012, a data packet is generated here, and the encoded data form fundamental series and an extended sequence according to the hierarchy of coding, respectively, and are sent out to a network 1021.

[0108] For example, in a multicast, one multicast group deserves one transmitting sequence. A data packet is sent to the FEC data generation section 1013, FEC data are generated based on the data packet of each sequence, and FEC data are packet-ized by the FEC data transmitting section 1014, and are sent out to coincidence in a network 1021. Similarly in a multicast, one multicast group deserves one FEC data sequence. Moreover, in the data transmitting section 1012, a sequence number (sequence number) and a time stump (data transmitting time information) are added independently to a data packet for every sequence, and a sequence number, the number of packets, etc. of a data packet which were used for FEC data are added as header information in the FEC data generation section 1013.

[0109] Next, the function and actuation of the receiving-side terminal 1002 are explained. Only the sequence chosen by the receiving sequence selection section 1036 is received in the data receive section 1031. A packet loss is detected from the sequence number added to the packet here, and it reports to the receiving sequence selection section 1036. In the receiving sequence selection section 1036, the reported information on a packet loss is totaled and a receiving sequence is changed with a fixed time interval based on it. The received data are sent to the error correction section 1033, when FEC data are received, and restoration processing of a loss packet is performed. After reconfigurating in the unit (for example, one frame) which can decode a data packet with decode equipment 1034, it decodes to a video signal.

[0110] Drawing 20 is the explanatory view showing the conceptual example by which the program and associated data of this invention are supplied to equipment from a storage. The program and associated data of this invention are supplied by inserting the storages 2001, such as a floppy disk and CD-ROM, in the insertion opening 2003 of a storage drive equipped by equipment 2002. Then, it becomes possible in loading to direct RAM, without once installing the program and associated data of this invention on a hard disk from a storage 2001, loading to RAM from a hard disk, or installing on a hard disk to perform the program of this invention.

[0111] In this case, when performing the program of this invention in the data communication unit concerning the gestalt of operation of the 2nd of this invention, program execution becomes possible by supplying the program and associated data of this invention to a data communication unit (the transmitting-side terminal 1001, receiving-side terminal 1002) in a procedure as shown in above-mentioned drawing 20 , or storing the program and associated data of this invention in a data communication unit (the transmitting-side terminal 1001, receiving-side terminal 1002) beforehand.
[0112] Drawing 19 is the explanatory view showing the example of a configuration of the contents of storage of the storage which memorized the program and associated data of this invention. The storage of this invention consists of contents of storage of volume information 1901, directory information 1902, the program execution file 1903, and program related data file 1904 grade. The program of this invention is program-code-ized based on the flow chart of below-mentioned drawing 16 etc.
[0113] In addition, the correspondence relation between each requirement for a configuration in the claim of this invention and each part of the data communication unit (the transmitting-side terminal 1001, receiving-side terminal 1002) concerning the gestalt of operation of the 2nd of this invention is as follows. A coding means corresponds to the coding equipment 1011 of the transmitting-side terminal 1001, and the data generation means for correction corresponds to the FEC data generation section 1013 of the transmitting-side terminal 1001. A transmitting means corresponds to the data transmitting section 1012 of the transmitting-side terminal 1001, and the FEC data transmitting section 1014. A data packet-ized means corresponds to the data transmitting section 1012 of the transmitting-side terminal 1001. The data packet-ized means for correction corresponds to the FEC data transmitting section 1014 of the transmitting-side terminal 1001. A selection means corresponds to the receiving sequence selection section 1036 of the receiving-side terminal 1002, a receiving means corresponds to the data receive section 1031 of the receiving-side terminal 1002, and the FEC data receive section 1032, and a condition acquisition means corresponds to the function which the receiving sequence selection section 1036 of the receiving-side terminal 1002 has. Moreover, the data communication unit of a transmitting side corresponds to the transmitting-side terminal 1001, the data communication unit of a receiving side corresponds to the receiving-side terminal 1002, and a network is equivalent to a network 1021.
[0114] next, about generation processing of the data for the error correction in the data communication unit concerning the gestalt of operation of the 2nd of this invention constituted like the above It is Motion as a coding method. JPEG (Joint Photographic Experts Group: color static-image compression method) Moreover, parity data are used as FEC data. It is RTP () to a communications protocol. [Rapid Transport] Protocol : the high-speed protocol / UDP (User Datagram Protocol: one of the multimedia protocols) / IP of the transport layer (Internet Protocol: protocol of the 3rd layer network layer of an OSI reference model) The case where it uses is explained referring to drawing 11 - drawing 15 for an example.
[0115] The image data for one frame are inputted into the coding equipment 1011 of the transmitting-side terminal 1001, and JPEG compression is performed. Although the encoded data are packet-ized for transmission, since fragmentation arises when this packet size is larger than the min MTU of a channel (it is 1500 bytes at the Max Transfer Unit:maximum transfer unit and Ethernet), they divide coded data beforehand and generate two or more packets so that the packet size generated may not exceed MTU. At this time, division is performed from the head of coded data so that the packet size after dividing in order to make small the overhead by the header added in the case of transmission as much as possible may become equal to MTU. It is 8 bytes of RTP to the divided data. A JPEG payload header (drawing 11) and 12 bytes of RTP header (drawing 12) are added, and one RTP packet is constituted (payload: information transmitted in a cel).
[0116] It is RTP to the FEC data generated when calculating to the whole RTP packet currently divided per MTU as mentioned above at that time, although one or more FEC data by performing bit operations, such as XOR (exclusive OR), to the packet of these plurality were generated. By adding a FEC payload header and a RTP header, a FEC packet exceeds MTU size and

fragmentation occurs (drawing 13). In order to avoid this, the FEC data of the same size as former data are generated only using a part for the JPEG data division of the data packets (drawing 14). Therefore, the header size which can be added to this FEC data is the same 20 bytes as it of former data, that is, should just design 8 bytes of the same FEC payload header as a JPEG payload header. The approach is explained below.

[0117] First, the header information needed for reconfigurating the original coded data from the data divided into two or more packets by the addressee side is a RTP header:data length, a marker bit, and a time stump RTP. JPEG payload header: It is six, image size, Q value, and offset, and it is necessary to also restore such information in the case of restoration of a ROSUTO packet. Moreover, information required in case a ROSUTO packet is restored using FEC is the sequence number and the number of packets for identifying the packet used for FEC data generation. It is necessary to restore these eight header information.

[0118] First, in such information, within image size, Q value (parameter which directs the compressibility (ratio of the amount of data of the still picture of a dimension, and the still picture after compression) of an image), and the frame same about a time stump, it is fixed, and since it is available, the value of a packet before and after receiving is not included in a header. Next, about offset, since it can restore using these when the data length and marker bit of a packet of order are obtained, it does not include in a header. Therefore, the information with the need of including in a header serves as a sequence number of a data length, a marker bit, and former data, and the number of packets. Since the part of all the packets used for FEC data generation is required for a data length and a marker bit, they include in a header what took such XOR here. The configuration of a FEC payload header is shown in drawing 15 . In addition, the technique of this FEC packet generation is applicable also in the gestalt of the 1st operation.

[0119] Then, the case where hierarchization is performed [approach / of the receiving sequence in the receiving side in the data communication unit concerning the gestalt of operation of the 2nd of this invention / selection] about the frame rate is explained concretely, referring to drawing 16 for an example.

[0120] First, in case reception of an image is started, an addressee receives only fundamental series (step S1601). It is equivalent to the participation to the multicast group by whom fundamental series are transmitted in the case of the multicast, and transmission of the join message of IGMP is used for this. After starting reception of fundamental series, the receiving-side terminal 1002 (addressee) measures the rate of a packet loss for every fixed time amount (step S1602). Since reception by the receive rate which the condition of NO) and a channel is good and requires mostly at the (step S1603 can be performed when the rate of a packet loss is less than a predetermined threshold, it considers raising an effective receive rate by receiving more data, and it newly [an extended sequence / one] receives (step S1607 - step S1609). In addition, one FEC sequence received when it judges that it judged whether current and a FEC sequence would be received and has received at step S1607 is reduced (step S1608), and it newly [an extended sequence / one] receives (step S1609), and on the other hand, when it judges that it has not received at step S1607, it newly [an extended sequence / one] receives (step S1609).

[0121] Moreover, at this time, when it displays after merging these by the receiving side and performing timing suitably by hierarchizing by the transmitting side so that the frame data of fundamental series may be interpolated by the frame data of an extended sequence, an effective frame rate can be raised. In addition, the time stump added to the packet can be used for the decision of the order of a frame in a merge.

[0122] On the other hand, when the rate of a packet loss which carried out [above-mentioned] measurement exceeds a threshold, YES) and the receive rate to demand are not attained at the (step S1603, but the effectiveness by receiving an extended sequence and raising the receive rate of data becomes weaker. Then, (step S1604 - step S1606), and error resistance can be raised by newly receiving one sequence of FEC data, and an effective receive rate can be raised by restoring the rate of a packet loss. In addition, one extended sequence received when it judges that it judged whether current and an extended sequence would be received and has received at step S1604 is reduced (step S1605), and it newly [a FEC sequence / one] receives

(step S1606), and on the other hand, when it judges that it has not received at step S1604, it newly [a FEC-sequence-/ one-] receives (step S1609).
[0123] Thus, an addressee can attain suitable receiving quality by changing raising raising a receiving data rate bordering on a certain threshold, and error resistance, and receiving.
[0124] Next, it explains, referring to drawing 17 about the decision approach of the threshold of the above-mentioned rate of a packet loss in the data communication unit concerning the gestalt of operation of the 2nd of this invention.
[0125] As a factor which determines this threshold, a coding method, compressibility, frame size, MTU of a channel, the redundancy of FEC, etc. are mentioned. Here, by the transmitting side, the threshold which corresponds, for example with reference to the table for every coding method as shown in drawing 17 shall be chosen from the parameter which notified parameters, such as frame size, and compressibility, redundancy of FEC, to the receiving side, and was notified in the addressee side as the decision approach. Such a table shall be created based on an actual measurement, simulation, etc. in an actual network, and shall be beforehand prepared for the addressee.
[0126] Next, it explains, referring to drawing 18 about the example of the grouping of the transmitting sequence in the data communication unit concerning the gestalt of operation of the 2nd of this invention.
[0127] In a situation which differ in the range whose bandwidth of the channel to which fundamental series are not restricted to one, a multicast becomes large-scale, and the addressee is connected when carrying out this invention is several figures As shown in drawing 18 , 64kbps(es) for ISDN (Integrated Service Digital Network: Comprehensive Digital Network), Two or more groups for every circuit, such as 384kbps(es) and 10Mbps(es) for LAN, are formed, and a transmit data sequence and an error correction data sequence are hierarchized in each group. And this invention is carried out also by each addressee's performing participation to the group who was suitable for each communication environment beforehand, and choosing the sequence in a group appropriately after that, and receiving.
[0128] As explained above, according to the data communication unit concerning the gestalt of operation of the 2nd of this invention, the transmitting-side terminal 1001 The FEC data generation section 1013 which generates FEC data to the coding equipment 1011 which encodes data hierarchical, and each data encoded hierarchical, the data encoded hierarchical, and FEC data are made into a respectively different data sequence. It has the data transmitting section 1012 and the FEC data transmitting section 1014 which transmit. The receiving-side terminal 1002 Since it has the receiving sequence selection section 1036 which chooses a suitable data sequence based on a receive state out of a respectively different data sequence, the data receive section 1031 which receives the selected data sequence, and the FEC data receive section 1032, following operations and effectiveness are done so.
[0129] In the above-mentioned configuration, for every unit which transmits data into a data sequence, the data transmitting section 1012 of the transmitting-side terminal 1001 adds data transmitting time information (time stump) and the sequence number (sequence number), and transmits. In this case, the data sequences transmitted by the data transmitting section 1012 are the fundamental series according to the hierarchy of coding of data, one or more extended sequences which are the upper layer of these fundamental series, and a FEC data sequence according to the FEC data generated to the data encoded hierarchical.
[0130] At the receiving-side terminal 1002, the rate of a data loss (rate of a packet loss) is acquired as a receive state. The receiving sequence selection section 1036 of an accepting station 1002 When the rate of a data loss is receiving a FEC data sequence smaller than a predetermined threshold When the received FEC data sequence is reduced, an extended sequence is received further and the rate of a data loss has not received the FEC data sequence smaller than a predetermined threshold Furthermore, when the extended sequence of a high order is received and the rate of a data loss is receiving an extended sequence more greatly than a predetermined threshold When the received extended sequence is reduced, a FEC data sequence is received further and the rate of a data loss has not received the extended sequence more greatly than a predetermined threshold, a FEC data sequence is received further.

[0131] This sets in the gestalt of operation of the 2nd of this invention. When performing data communication to much addressees and coincidence through a network, and each addressee sometimes chooses the rate of grant of a receive rate and FEC data accommodative according to the receiving situation of **** with the communication environment That is, the outstanding effectiveness that good communication link quality is realizable is acquired by choosing the receive rate and error resistance to which each addressee was suitable for each receiving environment. It is effective when distributing real time animation media especially in a multicast environment.

[0132] gestalt] of operation of others [[] -- in the gestalt of the 1st - the 2nd operation of this invention mentioned above, although not specified about a network class, when this invention is applied to large-scale networks, such as the Internet, its effectiveness is large. Moreover, this invention is applicable also to the data communication through various kinds of networks, such as LANs other than the Internet.

[0133] Moreover, in the gestalt of operation of the 1st of this invention mentioned above, although the camera server was raised and explained to the example as a transmitting-side terminal, this invention is not limited by this, either. For example, also when reproducing the animation file memorized by external storage and giving one's service to a client, it can apply.

[0134] Moreover, in the gestalt of operation of the 2nd of this invention mentioned above, as the transmitting-side terminal and the receiving-side terminal were shown in above-mentioned drawing 10 , the case where every one set each connected was raised to the network at the example, but this invention is not limited to the configuration of above-mentioned drawing 10 , and also when arbitration makes two or more set number connection of a transmitting-side terminal and the receiving-side terminal in a network, it can be applied.

[0135] In addition, this invention is not limited only to the equipment and the approach for realizing the above-mentioned operation gestalt, supplies the program code of the software for realizing the above-mentioned operation gestalt to the computer in the above-mentioned system or equipment (CPU or MPU), and also when the computer of the above-mentioned system or equipment operates the various above-mentioned devices according to this program code and it realizes the above-mentioned operation gestalt, it is contained under the category of this invention.

[0136] Moreover, the program code of the above-mentioned software itself will realize the function of the above-mentioned operation gestalt in this case, and the means for supplying that program code itself and its program code to a computer and the storage which specifically stored the above-mentioned program code are contained under the category of this invention.

[0137] As a storage which stores such a program code, a floppy disk, a hard disk, an optical disk, a magneto-optic disk, CD-ROM, a magnetic tape, the memory card of a non-volatile, ROM, etc. can be used, for example.

[0138] Moreover, not only when the above-mentioned computer controls various devices only according to the supplied program code and the function of the above-mentioned operation gestalt is realized, but when the above-mentioned operation gestalt is realized in collaboration with OS (operating system) to which the above-mentioned program code is working on a computer, or other applications, this program code is contained under the category of this invention.

[0139] Furthermore, after this supplied program code is stored in the memory with which the functional expansion unit connected to the functional add-in board and the computer of a computer is equipped, a part or all of processing that CPU with which that functional add-in board and functional expansion unit are equipped is actual is performed, and also when the above-mentioned operation gestalt is realized by that processing, it is contained under the category of this invention based on directions of that program code.

[0140]

[Effect of the Invention] As explained above, when performing data communication to much addressees and coincidence through a network according to the data telecommunication system according to claim 1 to 13, the outstanding effectiveness that good communication link quality is

realizable is acquired by choosing the receive rate and error resistance to which each addressee was suitable for each receiving environment. It is effective when distributing real time animation media especially in a multicast environment.

[0141] Moreover, according to a data communication unit according to claim 14 to 20 and the data communication unit according to claim 21 to 30, the outstanding effectiveness that good communication link quality is realizable is acquired like the above with constituting a data telecommunication system with the data communication unit of a transmitting side, and the data communication unit of a receiving side. It is effective when distributing real time animation media especially in a multicast environment.

[0142] Moreover, according to the data communication approach according to claim 31 to 43, the outstanding effectiveness that good communication link quality is realizable is acquired like the above by applying the data communication approach to a data telecommunication system (the data communication unit of a transmitting side, and data communication unit of a receiving side). It is effective when distributing real time animation media especially in a multicast environment.

[0143] Moreover, according to the storage according to claim 44 to 56, the outstanding effectiveness that good communication link quality is realizable is acquired like the above by reading the data transmitting approach from a storage and performing with a data telecommunication system (the data communication unit of a transmitting side, and data communication unit of a receiving side). It is effective when distributing real time animation media especially in a multicast environment.

[Translation done.]

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TECHNICAL FIELD

[Field of the Invention] About a data telecommunication system, a data communication unit, the data communication approach, and a storage, in more detail, this invention relates data generated regularly, such as an image and voice, to a suitable data telecommunication system, a data communication unit, the data communication approach, and a storage, when performing real time transmission/reception through a network.

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PRIOR ART

[Description of the Prior Art] Generally, when performing data communication in quality the network of not guaranteeing like the Internet, the data loss by the error produced in the network is not avoided. especially -- difference, such as H.263 (international standards of a full color dynamic-image coding method), and MPEG (Moving Picture Experts Group: full color dynamic-image compression method), -- when transmitting the dynamic image compressed by the codec, in order to spread the effect of a data loss also in the space of an image, and the direction of time amount, it has been a technical problem with the important correspondence to an error as a problem different from control of a transmitting rate.
[0003] As a means for restoring this data loss, the technique of Forward Error Correction (FEC: automatic error correction method) is considered. This transmits beforehand the data (FEC data) for performing an error correction to redundancy, when an error actually occurs in a network, it restores the data lost using this FEC data, and it is considered to be suitable for the communication link [real time / dynamic image / especially] in that the time delay which error restoration takes compared with the method which performs resending of loss data etc. can be suppressed comparatively low. As directions of FEC, Internet Draft (An RTP Payload Format for Generic Forward Error Correction) by IETF (Internet Engineering Task Force: Internet special technical investigating committee) is proposed.
[0004] In this case, how many the amounts of data of FEC are added changes with network situations. Then, the technique of adjusting the redundant amount of data for FEC is devised according to the network situation. Even if many terminals exist, such a technique is made on the assumption that it says [one kind of / which carried out data / transmit]. However, under the situation that many accepting stations exist, to adjust the error correction amount of data the optimal for every accepting station is desired.

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EFFECT OF THE INVENTION

[Effect of the Invention] As explained above, when performing data communication to much addressees and coincidence through a network according to the data telecommunication system according to claim 1 to 13, the outstanding effectiveness that good communication link quality is realizable is acquired by choosing the receive rate and error resistance to which each addressee was suitable for each receiving environment. It is effective when distributing real time animation media especially in a multicast environment.
[0141] Moreover, according to a data communication unit according to claim 14 to 20 and the data communication unit according to claim 21 to 30, the outstanding effectiveness that good communication link quality is realizable is acquired like the above with constituting a data telecommunication system with the data communication unit of a transmitting side, and the data communication unit of a receiving side. It is effective when distributing real time animation media especially in a multicast environment.
[0142] Moreover, according to the data communication approach according to claim 31 to 43, the outstanding effectiveness that good communication link quality is realizable is acquired like the above by applying the data communication approach to a data telecommunication system (the data communication unit of a transmitting side, and data communication unit of a receiving side). It is effective when distributing real time animation media especially in a multicast environment.
[0143] Moreover, according to the storage according to claim 44 to 56, the outstanding effectiveness that good communication link quality is realizable is acquired like the above by reading the data transmitting approach from a storage and performing with a data telecommunication system (the data communication unit of a transmitting side, and data communication unit of a receiving side). It is effective when distributing real time animation media especially in a multicast environment.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] On the other hand, when transmitting continuation media called image voice to two or more accepting stations through a network at coincidence on real time, the quality of the media which transmit poses a problem. When especially the network environments of each accepting station differ, the problem whether quality media should be transmitted according to the terminal connected in the network of a broadband or quality should be adjusted to a terminal without the capacity which only the media of low quality can receive arises. Then, it hierarchizes, media data are compressed and the technique of transmitting each hierarchy by another stream is proposed. Even if only a basic hierarchy receives, the data of minimum quality can be received, and the media of high quality can be gradually received now by joining the data stream (data sequence) of the upper layer one by one, and receiving to it more.
[0006] Thus, the accepting station with the narrow effective band during transmission and reception receives only the stream of a basic lower layer, minimum quality is acquired, the accepting station with the network of a broadband is received to the stream of the high order layer which can reproduce quality media, and the technique quality media are obtained is devised. By such technique, the data with which quality differs variously can be transmitted to two or more accepting stations accommodative. Furthermore, in order to correspond to the network where the dependability of a transmission line differs, it is desirable to also adjust the amount of addition of error correction data according to the network situation for every accepting station.
[0007] By the way, in the network where the networks (Ethernet (LAN of the bus structure which U.S. Xerox, DEC, and three companies of Intel developed jointly), ISDN (Integrated Service Digital Network: Comprehensive Digital Network), modem, etc.) of a different communication mode like the Internet are intermingled on the way, and various data flow into an intermediate node, a multiple address system like a multicast (method which transmits the same data to two or more terminals by one packet) is spreading. In such a situation, when transmitting continuation media called image voice to many accepting stations on real time at coincidence, according to the topology of the network for every accepting station, the amount of external traffic, etc., it is necessary to realize the data transmitting method for having taken into consideration the optimal quality and the optimal error resistance.
[0008] As mentioned above, the multicast communication link which carries out the multiple address of the media data, such as a dynamic image, to many addressees through a network is beginning to spread, but when performing such a communication link, the correspondence to greatly different communication environment among addressees poses a problem. That is, if superfluous data flow into an addressee's channel connected by narrow-band width of face when transmitting at the high rate according to the addressee who has connected with sufficient bandwidth, congestion arises and transmission at a low rate is conversely performed according to a low-speed circuit, it will be a problem of the addressee of a broadband using bandwidth and stopping going out. Since this problem is coped with, in the transmitting side, two or more hierarchized transmit data sequences (data stream) are transmitted, and the approach of choosing only a suitable sequence and receiving out of these data sequence, by the addressee side, is proposed. The addressee who the addressee who can use a broadband receives the sequence of a high rate or a large number by this, and is connected by the narrow-band line can

realize the communication link by the receive rate with each respectively suitable addressee by receiving only the sequence of a low rate or a fraction.

[0009] By the way, when the communication environment between addressees differs greatly like a multicast, the generating situations of an error also differ for every addressee, therefore it is necessary [for an addressee to be also able to choose extent of not only a receive rate but the error resistance guaranteed according to communication environment] in order to realize good communication link quality.

[0010] When it be make in view of the point mentioned above and perform data communication to much addressees and coincidence through a network , by choose the receive rate and the error resistance to which each addressee be suitable for each receiving environment , this invention realize good communication link quality , and aim at offer the data telecommunication system which enabled distribution of real time animation media especially in the multicast environment , a data communication unit , the data communication approach , and a storage .

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

MEANS

[Means for Solving the Problem] In order to attain the above-mentioned purpose, invention according to claim 1 It is the data telecommunication system which transmits and receives data through a network between the data communication unit of a transmitting side, and the data communication unit of two or more receiving sides. The data communication unit of said transmitting side A coding means to encode said data hierarchical and to generate coded data, A data generation means for correction to generate the data for error corrections to each coded data encoded hierarchical with this coding means, It has a transmitting means to transmit said coded data encoded hierarchical and data for said error corrections as a respectively different data sequence. The data communication unit of said receiving side It is characterized by having a selection means to choose a suitable data sequence based on a receive state from said respectively different data sequences, and a receiving means to receive the data sequence chosen with this selection means.
[0012] In order to attain the above-mentioned purpose, invention according to claim 2 is characterized by the data sequences transmitted with said transmitting means being the fundamental series according to the hierarchy of coding of said data, one or more extended sequences which are the upper layer of these fundamental series, and a data sequence for correction according to each data for correction generated to said data encoded hierarchical.
[0013] In order to attain the above-mentioned purpose, invention according to claim 3 is characterized by surely choosing said fundamental series from said data sequences by said selection means.
[0014] In order to attain the above-mentioned purpose, invention according to claim 4 Furthermore, a data packet-ized means for the data communication unit of said transmitting side to packet-ize the coded data encoded hierarchical with said coding means, and to generate a data packet, It has a data packet-ized means for correction to generate the packet for error corrections using the data for said error corrections. Said data generation means for correction The data for said error corrections are generated using said data packet, and said transmitting means is characterized by transmitting said data packet and said packet for error corrections as the data sequence of said coded data, and a data sequence of the data for said error corrections, respectively.
[0015] In order to attain the above-mentioned purpose, it is characterized by for said transmitting means adding data transmitting time information and the sequence number, and invention according to claim 5 transmitting it for every data packet within said data sequence.
[0016] In order to attain the above-mentioned purpose, invention according to claim 6 Said data generation means for correction generates the data for said error corrections only using the coded data part of this data packet with reference to the data packet of said data encoded hierarchical. Said data packet-ized means for correction is characterized by generating a payload header only including information indispensable at the time of an error correction, and generating said packet for error corrections using the data and said payload header for said error corrections.
[0017] In order to attain the above-mentioned purpose, it is characterized by invention according to claim 7 having a condition acquisition means by which the data communication unit of said

receiving side acquires said receive state further.
[0018] In order to attain the above-mentioned purpose, invention according to claim 8 is characterized by said condition acquisition means acquiring the rate of a data loss, a transmitting rate, and a receive rate as said receive state.
[0019] In order to attain the above-mentioned purpose, invention according to claim 9 The extended sequence which is a data sequence of the coded data of the upper layer further when said rate of a data loss of said selection means is larger than a threshold [smaller than a predetermined threshold] predetermined in the ratio of said transmitting rate and said receive rate is received. The data sequence for correction received when said rate of a data loss is smaller than a threshold [smaller than a predetermined threshold] predetermined in the ratio of said transmitting rate and said receive rate is reduced. When said rate of a data loss is larger than a larger threshold predetermined in the ratio of said transmitting rate and said receive rate than a predetermined threshold, the data sequence for correction is received further. When said rate of a data loss is smaller than a larger threshold predetermined in the ratio of said transmitting rate and said receive rate than a predetermined threshold, it is characterized by reducing the extended sequence to receive sequentially from the upper layer.
[0020] In order to attain the above-mentioned purpose, invention according to claim 10 is characterized by said condition acquisition means acquiring the rate of a data loss as said receive state.
[0021] In order to attain the above-mentioned purpose, invention according to claim 11 When said rate of a data loss is receiving the data sequence smaller than a predetermined threshold for said error corrections, said selection means Reduce the received data sequence for error corrections, and the extended sequence which is a data sequence of the coded data of the upper layer further is received. When said rate of a data loss has not received the data sequence smaller than a predetermined threshold for said error corrections Furthermore, when the extended sequence which is a data sequence of the coded data of the upper layer is received and said rate of a data loss is receiving an extended sequence more greatly than a predetermined threshold When the received extended sequence is reduced, the data sequence for said error corrections is received further and said rate of a data loss has not received the extended sequence more greatly than a predetermined threshold, it is characterized by receiving the data sequence for said error corrections further.
[0022] In order to attain the above-mentioned purpose, invention according to claim 12 is characterized by determining said predetermined threshold according to the coding method of said coded data.
[0023] In order to attain the above-mentioned purpose, invention according to claim 13 is characterized by the ability to apply to the multicast communication link which carries out the multiple address of the data, such as a dynamic image, to the data communication unit of two or more receiving sides through networks, such as the Internet, from the data communication unit of said transmitting side.
[0024] In order to attain the above-mentioned purpose, invention according to claim 14 A coding means to be the data communication unit which transmits data through a network to the data communication unit of two or more receiving sides, and to encode said data hierarchical and to generate coded data, A data generation means for correction to generate the data for error corrections to each coded data encoded hierarchical with this coding means, It is characterized by having a transmitting means to transmit said coded data encoded hierarchical and data for said error corrections as a respectively different data sequence.
[0025] In order to attain the above-mentioned purpose, invention according to claim 15 is characterized by the data sequences transmitted with said transmitting means being the fundamental series according to the hierarchy of coding of said data, one or more extended sequences which are the upper layer of these fundamental series, and a data sequence for correction according to each data for correction generated to said data encoded hierarchical.
[0026] In order to attain the above-mentioned purpose, invention according to claim 16 is characterized by surely choosing said fundamental series from said data sequences by the data communication unit of said receiving side.

[0027] In order to attain the above-mentioned purpose, invention according to claim 17 Furthermore, a data packet-ized means to packet-ize the coded data encoded hierarchical with said coding means, and to generate a data packet, It has a data packet-ized means for correction to generate the packet for error corrections using the data for said error corrections. Said data generation means for correction The data for said error corrections are generated using said data packet, and said transmitting means is characterized by transmitting said data packet and said packet for error corrections as the data sequence of said coded data, and a data sequence of the data for said error corrections, respectively.
[0028] In order to attain the above-mentioned purpose, it is characterized by for said transmitting means adding data transmitting time information and the sequence number, and invention according to claim 18 transmitting it for every data packet within said data sequence.
[0029] In order to attain the above-mentioned purpose, invention according to claim 19 Said data generation means for correction generates the data for said error corrections only using the coded data part of this data packet with reference to the data packet of said data encoded hierarchical. Said data packet-ized means for correction is characterized by generating a payload header only including information indispensable at the time of an error correction, and generating said packet for error corrections using the data and said payload header for said error corrections.
[0030] In order to attain the above-mentioned purpose, invention according to claim 20 is characterized by the ability to apply to the multicast communication link which carries out the multiple address of the data, such as a dynamic image, to the data communication unit of two or more receiving sides through networks, such as the Internet.
[0031] In order to attain the above-mentioned purpose, invention according to claim 21 is a data communication unit which receives data through a network from the data communication unit of a transmitting side, and is characterized by having a selection means to choose a suitable data sequence based on a receive state from the data sequences transmitted from the data communication unit of said transmitting side, and a receiving means to receive the data sequence chosen with this selection means.
[0032] In order to attain the above-mentioned purpose, invention according to claim 22 is characterized by the data sequences transmitted from the data communication unit of said transmitting side being the fundamental series according to the hierarchy of coding of said data, one or more extended sequences which are the upper layer of these fundamental series, and a data sequence for correction according to each data for correction generated to said data encoded hierarchical.
[0033] In order to attain the above-mentioned purpose, invention according to claim 23 is characterized by surely choosing said fundamental series from said data sequences by said selection means.
[0034] In order to attain the above-mentioned purpose, invention according to claim 24 is characterized by having further a condition acquisition means to acquire said receive state.
[0035] In order to attain the above-mentioned purpose, invention according to claim 25 is characterized by said condition acquisition means acquiring the rate of a data loss, a transmitting rate, and a receive rate as said receive state.
[0036] In order to attain the above-mentioned purpose, invention according to claim 26 The extended sequence which is a data sequence of the coded data of the upper layer further when said rate of a data loss of said selection means is larger than a threshold [smaller than a predetermined threshold] predetermined in the ratio of said transmitting rate and said receive rate is received. The data sequence for correction received when said rate of a data loss is smaller than a threshold [smaller than a predetermined threshold] predetermined in the ratio of said transmitting rate and said receive rate is reduced. When said rate of a data loss is larger than a larger threshold predetermined in the ratio of said transmitting rate and said receive rate than a predetermined threshold, the data sequence for correction is received further. When said rate of a data loss is smaller than a larger threshold predetermined in the ratio of said transmitting rate and said receive rate than a predetermined threshold, it is characterized by reducing the extended sequence to receive sequentially from the upper layer.

[0037] In order to attain the above-mentioned purpose, invention according to claim 27 is characterized by said condition acquisition means acquiring the rate of a data loss as said receive state.
[0038] In order to attain the above-mentioned purpose, invention according to claim 28 When said rate of a data loss is receiving the data sequence smaller than a predetermined threshold for said error corrections, said selection means Reduce the received data sequence for error corrections, and the extended sequence which is a data sequence of the coded data of the upper layer further is received. When said rate of a data loss has not received the data sequence smaller than a predetermined threshold for said error corrections Furthermore, when the extended sequence which is a data sequence of the coded data of the upper layer is received and said rate of a data loss is receiving an extended sequence more greatly than a predetermined threshold When the received extended sequence is reduced, the data sequence for said error corrections is received further and said rate of a data loss has not received the extended sequence more greatly than a predetermined threshold, it is characterized by receiving the data sequence for said error corrections further.
[0039] In order to attain the above-mentioned purpose, invention according to claim 29 is characterized by determining said predetermined threshold according to the coding method of said coded data.
[0040] In order to attain the above-mentioned purpose, invention according to claim 30 is characterized by the ability to apply to the multicast communication link to which the multiple address of the data, such as a dynamic image, is carried out through networks, such as the Internet, from the data communication unit of said transmitting side.
[0041] In order to attain the above-mentioned purpose, invention according to claim 31 It is the data communication approach applied to the data telecommunication system which transmits and receives data through a network between the data communication unit of a transmitting side, and the data communication unit of two or more receiving sides. The coding step which the data communication unit of said transmitting side encodes said data hierarchical, and generates coded data, The data generation step for correction which generates the data for error corrections to each coded data encoded hierarchical at this coding step, It has the transmitting step which transmits said coded data encoded hierarchical and data for said error corrections as a respectively different data sequence. The data communication unit of said receiving side It is characterized by having the selection step which chooses a suitable data sequence based on a receive state from said respectively different data sequences, and the receiving step which receives the data sequence chosen at this selection step.
[0042] In order to attain the above-mentioned purpose, invention according to claim 32 is characterized by the data sequences transmitted at said transmitting step being the fundamental series according to the hierarchy of coding of said data, one or more extended sequences which are the upper layer of these fundamental series, and a data sequence for correction according to each data for correction generated to said data encoded hierarchical.
[0043] In order to attain the above-mentioned purpose, invention according to claim 33 is characterized by surely choosing said fundamental series from said data sequences in said selection step. In order to attain the above-mentioned purpose, invention according to claim 34 Furthermore, the data packet-ized step which the data communication unit of said transmitting side packet-izes the coded data encoded hierarchical at said coding step, and generates a data packet, It has the data packet-ized step for correction which generates the packet for error corrections using the data for said error corrections. At said data generation step for correction The data for said error corrections are generated using said data packet, and it is characterized by transmitting said data packet and said packet for error corrections as the data sequence of said coded data, and a data sequence of the data for said error corrections, respectively at said transmitting step.
[0044] In order to attain the above-mentioned purpose, invention according to claim 35 is characterized by adding data transmitting time information and the sequence number, and transmitting for every data packet within said data sequence, at said transmitting step.
[0045] In order to attain the above-mentioned purpose, invention according to claim 36 At said

data generation step for correction, the data for said error corrections are generated only using the coded data part of this data packet with reference to the data packet of said data encoded hierarchical. At said data packet-ized step for correction, it is characterized by generating a payload header only including information indispensable at the time of an error correction, and generating said packet for error corrections using the data and said payload header for said error corrections.

[0046] In order to attain the above-mentioned purpose, it is characterized by invention according to claim 37 having the condition acquisition step from which the data communication unit of said receiving side acquires said receive state further.

[0047] In order to attain the above-mentioned purpose, invention according to claim 38 is characterized by acquiring the rate of a data loss, a transmitting rate, and a receive rate as said receive state at said condition acquisition step.

[0048] In order to attain the above-mentioned purpose, invention according to claim 39 At said selection step, the extended sequence which is a data sequence of the coded data of the upper layer further when said rate of a data loss is larger than a threshold [smaller than a predetermined threshold] predetermined in the ratio of said transmitting rate and said receive rate is received. The data sequence for correction received when said rate of a data loss is smaller than a threshold [smaller than a predetermined threshold] predetermined in the ratio of said transmitting rate and said receive rate is reduced. When said rate of a data loss is larger than a larger threshold predetermined in the ratio of said transmitting rate and said receive rate than a predetermined threshold, the data sequence for correction is received further. When said rate of a data loss is smaller than a larger threshold predetermined in the ratio of said transmitting rate and said receive rate than a predetermined threshold, it is characterized by reducing the extended sequence to receive sequentially from the upper layer.

[0049] In order to attain the above-mentioned purpose, invention according to claim 40 is characterized by acquiring the rate of a data loss as said receive state at said condition acquisition step.

[0050] In order to attain the above-mentioned purpose, invention according to claim 41 When said rate of a data loss is receiving the data sequence smaller than a predetermined threshold for said error corrections at said selection step Reduce the received data sequence for error corrections, and the extended sequence which is a data sequence of the coded data of the upper layer further is received. When said rate of a data loss has not received the data sequence smaller than a predetermined threshold for said error corrections Furthermore, when the extended sequence which is a data sequence of the coded data of the upper layer is received and said rate of a data loss is receiving an extended sequence more greatly than a predetermined threshold When the received extended sequence is reduced, the data sequence for said error corrections is received further and said rate of a data loss has not received the extended sequence more greatly than a predetermined threshold, it is characterized by receiving the data sequence for said error corrections further.

[0051] In order to attain the above-mentioned purpose, invention according to claim 42 is characterized by determining said predetermined threshold according to the coding method of said coded data.

[0052] In order to attain the above-mentioned purpose, invention according to claim 43 is characterized by the ability to apply to the multicast communication link which carries out the multiple address of the data, such as a dynamic image, to the data communication unit of two or more receiving sides through networks, such as the Internet, from the data communication unit of said transmitting side.

[0053] In order to attain the above-mentioned purpose, invention according to claim 44 It is the storage in which read-out [computer / which memorized the program which performs the data communication approach applied to the data telecommunication system which transmits and receives data through a network between the data communication unit of a transmitting side and the data communication unit of two or more receiving sides] is possible. The coding step which said data communication approach encodes said data hierarchical, and generates coded data, The data generation step for correction which generates the data for error corrections to each

coded data encoded hierarchical at this coding step, The transmitting step controlled to transmit said coded data encoded hierarchical and data for said error corrections as a respectively different data sequence, It is characterized by having the selection step which chooses a suitable data sequence based on a receive state from said respectively different data sequences, and the receiving step controlled to receive the data sequence chosen at this selection step.
[0054] In order to attain the above-mentioned purpose, invention according to claim 45 is characterized by the data sequences which carry out a transmission control at said transmitting step being the fundamental series according to the hierarchy of coding of said data, one or more extended sequences which are the upper layer of these fundamental series, and a data sequence for correction according to each data for correction generated to said data encoded hierarchical.

[0055] In order to attain the above-mentioned purpose, invention according to claim 46 is characterized by surely choosing said fundamental series from said data sequences in said selection step.
[0056] In order to attain the above-mentioned purpose, invention according to claim 47 Furthermore, the data packet-ized step which packet-izes the coded data encoded hierarchical at said coding step, and generates a data packet, It has the data packet-ized step for correction which generates the packet for error corrections using the data for said error corrections. At said data generation step for correction The data for said error corrections are generated using said data packet. At said transmitting step It is characterized by controlling to transmit said data packet and said packet for error corrections as the data sequence of said coded data, and a data sequence of the data for said error corrections, respectively.
[0057] In order to attain the above-mentioned purpose, invention according to claim 48 is characterized by controlling by said transmitting step to add data transmitting time information and the sequence number, and to transmit for every data packet within said data sequence.
[0058] In order to attain the above-mentioned purpose, invention according to claim 49 At said data generation step for correction, the data for said error corrections are generated only using the coded data part of this data packet with reference to the data packet of said data encoded hierarchical. At said data packet-ized step for correction, it is characterized by generating a payload header only including information indispensable at the time of an error correction, and generating said packet for error corrections using the data and said payload header for said error corrections.
[0059] In order to attain the above-mentioned purpose, invention according to claim 50 is characterized by having further the condition acquisition step which acquires said receive state.
[0060] In order to attain the above-mentioned purpose, invention according to claim 51 is characterized by acquiring the rate of a data loss, a transmitting rate, and a receive rate as said receive state at said condition acquisition step.
[0061] In order to attain the above-mentioned purpose, invention according to claim 52 It controls by said selection step to receive the extended sequence which is a data sequence of the coded data of the upper layer further when said rate of a data loss is larger than a threshold [smaller than a predetermined threshold] predetermined in the ratio of said transmitting rate and said receive rate. The data sequence for correction received when said rate of a data loss is smaller than a threshold [smaller than a predetermined threshold] predetermined in the ratio of said transmitting rate and said receive rate is reduced. It controls to receive the data sequence for correction further, when said rate of a data loss is larger than a larger threshold predetermined in the ratio of said transmitting rate and said receive rate than a predetermined threshold. When said rate of a data loss is smaller than a larger threshold predetermined in the ratio of said transmitting rate and said receive rate than a predetermined threshold, it is characterized by reducing the extended sequence to receive sequentially from the upper layer.
[0062] In order to attain the above-mentioned purpose, invention according to claim 53 is characterized by acquiring the rate of a data loss as said receive state at said condition acquisition step.
[0063] In order to attain the above-mentioned purpose, invention according to claim 54 When said rate of a data loss is receiving the data sequence smaller than a predetermined threshold

for said error corrections at said selection step It controls to reduce the received data sequence for error corrections, and to receive the extended sequence which is a data sequence of the coded data of the upper layer further. When said rate of a data loss has not received the data sequence smaller than a predetermined threshold for said error corrections Furthermore, when it controls to receive the extended sequence which is a data sequence of the coded data of the upper layer and said rate of a data loss is receiving an extended sequence more greatly than a predetermined threshold When it controls to reduce the received extended sequence and to receive the data sequence for said error corrections further and said rate of a data loss has not received the extended sequence more greatly than a predetermined threshold, it is characterized by controlling to receive the data sequence for said error corrections further.

[0064] In order to attain the above-mentioned purpose, invention according to claim 55 is characterized by determining said predetermined threshold according to the coding method of said coded data.

[0065] In order to attain the above-mentioned purpose, invention according to claim 56 is characterized by the ability to apply to the multicast communication link which carries out the multiple address of the data, such as a dynamic image, to the data communication unit of two or more receiving sides through networks, such as the Internet, from the data communication unit of said transmitting side.

[0066]

[Embodiment of the Invention] Hereafter, the gestalt of the 2nd operation is explained to the gestalt list of operation of the 1st of this invention at a detail based on a drawing.

[0067] [Gestalt of the 1st operation] drawing 1 is the block diagram showing the configuration of the data communication unit concerning the gestalt of operation of the 1st of this invention. As for the data communication unit concerning the gestalt of operation of the 1st of this invention, a transmit terminal 1-1, and two or more accepting stations 1-21 and 1-22 -- are constituted possible [a communication link] through the network 1-3. Drawing 1 shows the internal configuration and connection relation of each terminal in the case of receiving the data which a transmit terminal 1-1 transmits by the accepting station 1-21 and 1-22 -- through a network 1-3.

[0068] Furthermore, the above-mentioned transmit terminal 1-1 is equipped with the data generation section 1-11, the layer 1 transmitting section (BaseLayer1) 1-121, the layer 2 transmitting section (FECLayer1) 1-122, the layer 3 transmitting section (Enhancement Layer 2) 1-123, the layer 4 transmitting section (FEC Layer 2) 1-124, and the layer 5 transmitting section (Enhancement Layer 3) 1-125. Furthermore, the above-mentioned accepting station 1-21 is equipped with the data receive section 1-211, the data-processing section 1-212, the receiving layer selection section 1-213, and the receiving status monitor section 1-124. In addition, other accepting-station 1-22 -- omits illustration like the above-mentioned accepting station 1-21 for a configuration.

[0069] Here, it does not contain to a large-scale thing which many and unspecified networks [like LAN (Local Area Network) currently managed by the in-house to the so-called Internet] whose network 1-3 in the gestalt of operation of the 1st of this invention is combined, and does not specify about the gestalt.

[0070] Although the image data by which the capture was specifically carried out with the video camera as data which a transmit terminal 1-1 transmits can be considered if the above-mentioned configuration is explained in full detail with actuation, as contents of data, it does not restrict to an image. In a transmit terminal 1-1, the data generation section 1-11 encodes the media which transmit hierarchical. Since hierarchy coding is used, although it is of inferior quality when it reappears only by the Base layer (fundamental series), media are reproducible at worst. The Enhancement layer (extended sequence) of a high order is combining with a Base layer and using, and can reproduce media in high quality more. For example, resolution serves as a high, high image of a frame rate in case of the case of an image. The data by which hierarchy coding was carried out are packet-ized for transmission, and the FEC data for an error correction are generated about each hierarchy based on the packet-ized data. A parity packet etc. shall be used as FEC data.

[0071] A Base layer, each Enhancement layer, and the error correction layer to each are sent to another layer transmitting section (data transmitting section) 1-121 to 1-125 as a respectively different stream. The layer transmitting section (data transmitting section) 1-121 to 1-125 adds the information on time of day that a sequence number and data are transmitted for every packet, sends out each layer to a network 1-3 as another stream, and carries out a multicast (distribute the same information to two or more specific destinations) to it. It shall be chosen by the accepting station 1-21 and 1-22 -- which layer is received.
[0072] On the other hand, each accepting station 1-21 and 1-22 -- receive only a suitable thing among each layer transmitted. The received data are sent to the data-processing section 1-212, and are processed. For example, when data are an image, processings (a decryption, display process, etc.) for displaying an image are performed in the data-processing section 1-212. In each accepting station 1-21 and 1-22 --, during data reception, the receiving status monitor section 1-214 carries out the monitor of the receiving situations, such as a packet loss and a transit delay, and sends the information to the receiving layer selection section 1-213. The receiving layer selection section 1-213 determines the layer which should receive according to the sent receiving situation. It reports that the receiving layer selection section 1-213 receives about the determined layer to the data receive section 1-211, and the data receive section 1-211 continues receiving the specified layer.
[0073] Next, the transmit terminal 1-1 of the data communication unit concerning the gestalt of operation of the 1st of this invention constituted like the above and each accepting station 1-21, 1-22 -- It explains referring to drawing 2 - drawing 4 about actuation. The flow chart which shows the data transmitting processing by the side of the transmit terminal of the data communication unit which drawing 2 requires for the gestalt of operation of the 1st of this invention, the flow chart which shows the data reception by the side of the accepting station of the data communication unit which drawing 3 requires for the gestalt of operation of the 1st of this invention, and drawing 4 are the accepting station 1-21 of the data communication unit concerning the gestalt of operation of the 1st of this invention, and a flow chart which shows the receiving layer selection processing in 1-22 --.
[0074] First, actuation of the transmit terminal 1-1 of a data communication unit is explained based on the flow chart of drawing 2 .
[0075] First, in a transmit terminal 1-1, the data which should be transmitted are incorporated (step S201) and hierarchy coding of the data is carried out (step S202). With a hierarchy coding technique, most, based on a low-ranking Base layer, it shall compress by adding an Enhancement layer one by one from low order, so that quality improves gradually. Each hierarchy's data are packet-ized and the stream of a Base layer and the stream of each Enhancement layer are generated (step S203). For example, when it encodes to three hierarchies, two-layer generation of the stream of one layer and an Enhancement layer will be carried out for the stream of a Base layer.
[0076] And with reference to a data packet, the packet for an error correction is generated about each hierarchy's data, and one stream of data streams of a FEC layer is generated at a time about each hierarchy (step S204). A parity packet etc. may be used for an error correction. Thus, with the media data and FEC data which were hierarchized, the layer of a data stream is generated and it is sent out on a network 1-3 as a respectively different data stream (step S205). In case data are sent out to a network 1-3 (step S205), the sequence number managed the whole stream and the information on the time stump of transmitting time of day are given to a packet.
[0077] Next, each accepting station 1-21 of the data communication unit concerning the gestalt of operation of the 1st of this invention, 1-22 -- Actuation is explained based on the flow chart of drawing 3 .
[0078] In each accepting station 1-21 and 1-22 --, the data transmitted through a network 1-3 from the transmit terminal 1-1 are received in the data receive section 1-211 (step S301). The data sent from the transmit terminal 1-1 are processed in the data-processing section 1-212 (step S302). The display of an image etc. is performed when for example, image data have been sent from the transmit terminal 1-1.

[0079] Each accepting station 1-21 and 1-22 -- are one side, and carry out the monitor of the statistical information of a transceiver situation periodically (step S303). As a transceiver situation at this time, the rate of a packet loss, a transmitting rate, a receive rate, etc. are mentioned. Although the rate of a packet loss is missing among the sequence numbers given to the transmit data, it is measurable from a number. A transmitting rate can be guessed from the time stump and sequence number which were given to the transmit data. Moreover, a receive rate is easily calculable with the packet size of received data, and the log of time of day. And the layer of the data which the accepting station should receive is chosen from the transceiver situation (step S304). When a receiving layer has modification by selection, the layer which actually receives is changed (step S305), and reception of data is continued after modification about the data of the layer which will receive.

[0080] Next, the receiving layer selection processing in the accepting station 1-21 of the data communication unit concerning the gestalt of operation of the 1st of this invention and 1-22 -- is explained based on the flow chart of drawing 4 .

[0081] First, the rate of a packet loss is investigated and the ratio of the receive rate to a transmitting rate is compared with a threshold (for example, 0.9) below as compared with a threshold (for example, 5%) (step S401) (step S402). The rate of a loss is smaller than a threshold, and when a transceiver rate ratio is larger than a threshold, since I hear that there are also few losses, the Enhancement layer of the upper layer shall be further received by allowances being in a band (step S403). Although the rate of a loss is smaller than a threshold, and it is thought that there are few losses and the quality of a channel is good when a transceiver rate ratio is also smaller than a threshold, what transmitted cannot fully be received but it is thought that there is only no bandwidth which fully receives the amount of data transmitted. In this case, since it is not necessary to receive a redundant FEC layer vainly, the FEC layer which has received is reduced (step S404).

[0082] Since it is thought that there is no dependability in a channel, it is newly begun for the rate of a loss to be larger than a threshold, for the bandwidth of a network 1-3 to be enough when a transceiver rate ratio is sufficiently larger than a threshold, but to receive a FEC layer (step S406). On the other hand, since it is thought that the rate of a loss is larger than a threshold, and bandwidth is fundamentally insufficient when a transceiver rate ratio is smaller than a threshold, the Enhancement layer which receives is reduced sequentially from the thing of a high order (step S407). Under the present circumstances, when the FEC layer about the Enhancement layer which cancels that reception has also received, reception of this FEC layer is also stopped.

[0083] Repeating the above steps, a transmit terminal 1-1 sends out the data stream of the data by which hierarchy coding was carried out, and two or more layers generated by FEC for an error correction on a network 1-3. In an accepting station 1-21 and 1-22 --, according to a receiving situation, the data of a layer suitable as mentioned above are chosen, and it receives.

[0084] Drawing 5 is the explanatory view showing the transceiver situation of the hierarchized data that it is realizable with the above-mentioned technique concerning the gestalt of operation of the 1st of this invention. Among drawing, the bottom is a transmitting side and is the example of the hierarchical data currently prepared by hierarchy coding and the error correction. A Base layer and two Enhancement layers are generated in this example. The FEC layer for every one-layer error correction of three layers is prepared for a total of three data streams, respectively. Only a Base stream will receive the narrow accepting station (client) of a network band like [in / A / drawing].

[0085] Although the accepting station with a network band large on the other hand to some extent (client) will receive three data streams like [for example, in / B or C / drawing], the accepting station connected by the unstable network with many packet losses receives a FEC stream like [in / B / drawing]. The accepting station connected in the network which, on the other hand, has dependability with few packet losses will not receive a FEC stream like [in / C / drawing], but will receive a media data stream to the quality top layer.

[0086] Drawing 6 is the block diagram showing the example which applied the data communication unit concerning the gestalt of operation of the 1st of this invention mentioned

above to the data telecommunication system. The profile configuration of the data telecommunication system concerning the gestalt of operation of the 1st of this invention is carried out from the camera server 10 and the client 20. Furthermore, the camera server 10 is equipped with a camera 100, the capture section 101, an interface 102, CPU103, ROM104 and RAM105, external storage 106, the keyboard 107, the display 108, and the communication interface 109. Furthermore, the client 20 is equipped with CPU203, ROM204, RAM205, external storage 206, the keyboard 207, the display 208, and the communication interface 209. 300 in drawing shows a network.

[0087] If the above-mentioned configuration is explained in full detail, the camera server 10 will transmit the image data photoed with the camera 100 to a client 20 through a network 300. In correspondence with the configuration of drawing 6 , and the configuration of above-mentioned drawing 1 , the camera server 10 corresponds to a transmit terminal 1-1, and dealing with an accepting station 1-21 can understand a client 20. Furthermore, two or more these clients 20 will exist in a different location connected in the network 300.

[0088] Now, the hardware-difference between the camera server 10 and a client 20 is a difference in whether it has a camera and the capture section, and the camera server 10 and client 20 both sides can realize it with a personal computer. That is, signs 103-109 and signs 203-209 are the same configurations substantially, and each can realize them by general-purpose computer (for example, personal computer).

[0089] On the other hand, it differs in that the software (it is stored in external storage 206, and it is loaded to RAM205 and performs) which the software (it is stored in external storage 106, and it is loaded to RAM105 and performs) for compressing the image data which carried out the capture in the camera server 10, generating the data of an error correction, and transmitting to a client 20 is operating, receives image data in a client 20, and displays it operates by software. About compression of data, although it is also possible to also carry out in hardware by the capture card and to carry out by software, it becomes the conditions for realizing the gestalt of operation of the 1st of this invention that it is compressible using a hierarchy coding technique.

[0090] However, in this example, when it divides into the camera server 10 and a client 20 for convenience, and is only shown and video capture ability is added to both sides, both sides can function as a camera server and a client.

[0091] Now, it explains, referring to the flow chart of drawing 7 - drawing 9 about the actuation in the case of applying actuation of the data communication unit of above-mentioned drawing 1 explained previously to the data telecommunication system of drawing 6 . The flow chart which shows the transmitting processing in the camera server which drawing 7 requires for the gestalt of operation of the 1st of this invention, the flow chart which shows the data reception in the client which drawing 8 requires for the gestalt of operation of the 1st of this invention, and drawing 9 are flow charts which show the receiving layer modification processing in the client concerning the gestalt of operation of the 1st of this invention.

[0092] First, it explains from actuation of the camera server 10 (drawing 7). First, in the camera server 10, the image which carried out the capture from the camera 100 in the capture section 101 according to capture spacing is incorporated (step S701). Hierarchy coding of the image by which the capture was carried out in the capture section 101 is carried out at two or more hierarchies (step S702). Next, it is divided into the packet of suitable magnitude for every hierarchy (step S703). Furthermore, the parity packet for an error correction is generated about the media data of each packet-ized layer (step S704). A parity packet shall be added to one number packet of media data.

[0093] Thus, rate adjustment is carried out so that it may be enough for the following capture timing, and the data of each generated layer are transmitted on a network 300 as a respectively different data stream (step S705). The camera server 10 repeats from the capture of an image to transmission periodically as mentioned above.

[0094] On the other hand, although it is processing of a client 20, data reception (drawing 8) is explained first. First, in a client 20, the data of the receiving layer which arrived from the camera server 10 are received (step S801). When a packet loss is investigated and there is a loss in the phase at which data of one frame arrived, an error correction packet recovers (step S802). Next,

the data after an error correction are decoded, an image is generated (step S803), and it displays on a display 208 (step S804).
[0095] Next, the receiving layer modification processing (drawing 9) by the client 20 is explained. First, in a client 20, an initial receiving layer is decided at the time of starting (step S811), and an initial layer change timer is set up (step S812). Next, when it confirms whether the time amount of an initial layer change timer has run out (step S813) and the time amount of an initial layer change timer has passed, the statistical information of a receiving situation is checked (step S814). Next, according to above-mentioned technique (drawing 4), a receiving layer is determined and changed from the receiving situation (step S815). Modification of this receiving layer does effect as modification of the assignment receiving layer of the above-mentioned reception. Then, a receiving layer change timer is set up again (step S816), and processing of return and the above-mentioned step S813 to the step S816 is repeated to the above-mentioned step S813.
[0096] The above result, when hierarchy coding and an error correction generate two or more streams by the transmit-terminal side and an accepting station chooses the optimal receiving data stream according to the situation of the network for every accepting station, the optimal data transfer can perform coincidence data transfer to two or more accepting stations through a network.
[0097] When the Internet is assumed as a target network with the above-mentioned operation gestalt, as a method of sending out the data to a network, IP (Internet Protocol) multicast standardized from IETF (Internet EngineeringTask Force) can be used. In this case, an accepting station can use join to a multicast group and the message of leave which used IGMP (Internet Group Membership Protocol) as an approach of choosing the stream which receives from two or more layers.
[0098] Moreover, although it is the data rate of the Base layer of the above-mentioned operation gestalt, and an Enhancement layer, to enable it to set this up suitably according to the class of interface linked to a network class and its network is desired. For example, if the above-mentioned system is built in the company, since it will be Ethernet (Ethernet: LAN, transmission-speed:10Mbps and 100Mbps(es) of a bus structure which U.S. Xerox, DEC, and three companies of Intel developed jointly), it will be able to be set as the high transfer rate.
[0099] As explained above, according to the data communication unit concerning the gestalt of operation of the 1st of this invention While transmitting the data generation section 1-11 which encodes the data of the media for transmission hierarchical, and hierarchy coded data as a respectively different data stream The transmit terminal 1-1 equipped with the layer transmitting section 1-121 to 1-125 which generates the data for error corrections to each data stream, and transmits as another stream respectively, Since it has the accepting station 1-21 equipped with the receiving status monitor section 1-214 which carries out the monitor of the receiving situation, the receiving layer selection section 1-213 which chooses a suitable data stream based on a receiving situation, and the data receive section 1-211 which receives the selected data stream, Following operations and effectiveness are done so.
[0100] In the above-mentioned configuration, by the transmit terminal 1-1, generation of the packet for an error correction and the data stream of a FEC layer are performed about data-hierarchy coding for transmission, packet-izing of each hierarchy's data, generation of the stream of a Base layer, and the stream of each Enhancement layer, and each hierarchy's data, and it generates one stream of layers of a data stream at a time with generation, hierarchization media data, and FEC data about each hierarchy, and sends out to a network 1-3 as another data stream respectively. The sequence number managed the whole stream and the information on the time stump of transmitting time of day are given to a packet.
[0101] In an accepting station 1-21 and 1-22 --, the receiving layer based on the monitor of the statistical information of a transceiver situation, selection of the layer of data which should receive based on a transceiver situation, and receiving layer selection is changed periodically, and reception of data is continued about the data of the receiving layer after modification.
[0102] Moreover, when the rate of a loss of a packet is smaller than a threshold and a transceiver rate ratio is larger than a threshold in an accepting station 1-21 and 1-22 --, The

Enhancement layer of the upper layer is received. Furthermore, when the rate of a loss is smaller than a threshold and a transceiver rate ratio also has it, [smaller than a threshold] The FEC layer which has received is reduced. When [than a threshold / that the rate of a loss is larger] a transceiver rate ratio is sufficiently larger than a threshold, A FEC layer is newly received, and when [than a threshold / that the rate of a loss is larger] a transceiver rate ratio is smaller than a threshold, the Enhancement layer which receives is reduced sequentially from the thing of a high order.

[0103] Thereby, in case data transmission is carried out to two or more accepting stations through a network in the gestalt of operation of the 1st of this invention from a transmit terminal, according to the situation of an intervening different network for every accepting station, it becomes possible to transmit data with the optimal quality and the optimal error resistance. Therefore, when you need real time nature which relays at coincidence the raw image photoed with the camera to many viewers, the outstanding effectiveness of acting effectively especially is acquired.

[0104] [Gestalt of the 2nd operation] drawing 10 is the block diagram showing the configuration of the data communication unit concerning the gestalt of operation of the 2nd of this invention. As for the data communication unit concerning the gestalt of operation of the 2nd of this invention, the transmitting-side terminal 1001 and the receiving-side terminal 1002 are constituted possible [a communication link] through the network 1021. Furthermore, the above-mentioned transmitting-side terminal 1001 is equipped with image capture equipment 1010, coding equipment 1011, the data transmitting section 1012, the FEC data generation section 1013, and the FEC data transmitting section 1014. Furthermore, the above-mentioned receiving-side terminal 1002 is equipped with the data receive section 1031, the FEC data receive section 1032, the error correction section 1033, decode equipment 1034, an image display device 1035, and the receiving sequence selection section 1036.

[0105] If the outline function of each part of the above-mentioned transmitting-side terminal 1001 and the receiving-side terminal 1002 is explained, in the transmitting-side terminal 1001, image capture equipment 1010 will capture the image of the display screen as a file. Coding equipment 1011 generates a hierarchical data sequence from the inputted video signal. The data transmitting section 1012 generates a data packet based on coded data, forms fundamental series and an extended sequence according to the hierarchy of coding, and sends them out to a network 1021. The FEC data generation section 1013 generates FEC data based on the data packet of each sequence. The FEC data transmitting section 1014 packet-izes FEC data, and sends them out to a network 1021.

[0106] On the other hand, in the receiving-side terminal 1002, the data receive section 1031 receives coded data through a network 1021. The FEC data receive section 1032 receives FEC data through a network 1021. The error correction section 1033 performs restoration processing of a loss packet. Decode equipment 1034 decodes coded data. An image display device 1035 displays the received image. The receiving sequence selection section 1036 changes a receiving sequence with a fixed time interval based on the information on a packet loss.

[0107] Furthermore, the function of the important section of the above-mentioned transmitting-side terminal 1001 and the receiving-side terminal 1002 is explained in full detail with actuation. First, the function and actuation of the transmitting-side terminal 1001 are explained. Coding equipment 1011 generates a hierarchical data sequence from the inputted video signal. Although the approach one encoder outputs two or more coded data from which resolution and an SN ratio differ about a hierarchy target's approach, the approach of outputting the coding sequence from which a frame rate differs using two or more encoders, etc. can be used, it does not specify about the approach here. It is sent to the data transmitting section 1012, a data packet is generated here, and the encoded data form fundamental series and an extended sequence according to the hierarchy of coding, respectively, and are sent out to a network 1021.

[0108] For example, in a multicast, one multicast group deserves one transmitting sequence. A data packet is sent to the FEC data generation section 1013, FEC data are generated based on the data packet of each sequence, and FEC data are packet-ized by the FEC data transmitting section 1014, and are sent out to coincidence in a network 1021. Similarly in a multicast, one

multicast group deserves one FEC data sequence. Moreover, in the data transmitting section 1012, a sequence number (sequence number) and a time stump (data transmitting time information) are added independently to a data packet for every sequence, and a sequence number, the number of packets, etc. of a data packet which were used for FEC data are added as header information in the FEC data generation section 1013.

[0109] Next, the function and actuation of the receiving-side terminal 1002 are explained. Only the sequence chosen by the receiving sequence selection section 1036 is received in the data receive section 1031. A packet loss is detected from the sequence number added to the packet here, and it reports to the receiving sequence selection section 1036. In the receiving sequence selection section 1036, the reported information on a packet loss is totaled and a receiving sequence is changed with a fixed time interval based on it. The received data are sent to the error-correction section 1033, when FEC data are received, and restoration processing of a loss packet is performed. After reconfigurating in the unit (for example, one frame) which can decode a data packet with decode equipment 1034, it decodes to a video signal.

[0110] Drawing 20 is the explanatory view showing the conceptual example by which the program and associated data of this invention are supplied to equipment from a storage. The program and associated data of this invention are supplied by inserting the storages 2001, such as a floppy disk and CD-ROM, in the insertion opening 2003 of a storage drive equipped by equipment 2002. Then, it becomes possible in loading to direct RAM, without once installing the program and associated data of this invention on a hard disk from a storage 2001, loading to RAM from a hard disk, or installing on a hard disk to perform the program of this invention.

[0111] In this case, when performing the program of this invention in the data communication unit concerning the gestalt of operation of the 2nd of this invention, program execution becomes possible by supplying the program and associated data of this invention to a data communication unit (the transmitting-side terminal 1001, receiving-side terminal 1002) in a procedure as shown in above-mentioned drawing 20 , or storing the program and associated data of this invention in a data communication unit (the transmitting-side terminal 1001, receiving-side terminal 1002) beforehand.

[0112] Drawing 19 is the explanatory view showing the example of a configuration of the contents of storage of the storage which memorized the program and associated data of this invention. The storage of this invention consists of contents of storage of volume information 1901, directory information 1902, the program execution file 1903, and program related data file 1904 grade. The program of this invention is program-code-ized based on the flow chart of below-mentioned drawing 16 etc.

[0113] In addition, the correspondence relation between each requirement for a configuration in the claim of this invention and each part of the data communication unit (the transmitting-side terminal 1001, receiving-side terminal 1002) concerning the gestalt of operation of the 2nd of this invention is as follows. A coding means corresponds to the coding equipment 1011 of the transmitting-side terminal 1001, and the data generation means for correction corresponds to the FEC data generation section 1013 of the transmitting-side terminal 1001. A transmitting means corresponds to the data transmitting section 1012 of the transmitting-side terminal 1001, and the FEC data transmitting section 1014. A data packet-ized means corresponds to the data transmitting section 1012 of the transmitting-side terminal 1001. The data packet-ized means for correction corresponds to the FEC data transmitting section 1014 of the transmitting-side terminal 1001. A selection means corresponds to the receiving sequence selection section 1036 of the receiving-side terminal 1002, a receiving means corresponds to the data receive section 1031 of the receiving-side terminal 1002, and the FEC data receive section 1032, and a condition acquisition means corresponds to the function which the receiving sequence selection section 1036 of the receiving-side terminal 1002 has. Moreover, the data communication unit of a transmitting side corresponds to the transmitting-side terminal 1001, the data communication unit of a receiving side corresponds to the receiving-side terminal 1002, and a network is equivalent to a network 1021.

[0114] next, about generation processing of the data for the error correction in the data communication unit concerning the gestalt of operation of the 2nd of this invention constituted

like the above It is Motion as a coding method. JPEG (Joint Photographic Experts Group: color static-image compression method) Moreover, parity data are used as FEC data. It is RTP () to a communications protocol. [Rapid Transport] Protocol : the high-speed protocol / UDP (User Datagram Protocol: one of the multimedia protocols) / IP of the transport layer (Internet Protocol: protocol of the 3rd layer network layer of an OSI reference model) The case where it uses is explained referring to drawing 11 - drawing 15 for an example.

[0115] The image data for one frame are inputted into the coding equipment 1011 of the transmitting-side terminal 1001, and JPEG compression is performed. Although the encoded data are packet-ized for transmission, since fragmentation arises when this packet size is larger than the min MTU of a channel (it is 1500 bytes at the Max Transfer Unit:maximum transfer unit and Ethernet), they divide coded data beforehand and generate two or more packets so that the packet size generated may not exceed MTU. At this time, division is performed from the head of coded data so that the packet size after dividing in order to make small the overhead by the header added in the case of transmission as much as possible may become equal to MTU. It is 8 bytes of RTP to the divided data. A JPEG payload header (drawing 11) and 12 bytes of RTP header (drawing 12) are added, and one RTP packet is constituted (payload: information transmitted in a cel).

[0116] It is RTP to the FEC data generated when calculating to the whole RTP packet currently divided per MTU as mentioned above at that time, although one or more FEC data by performing bit operations, such as XOR (exclusive OR), to the packet of these plurality were generated. By adding a FEC payload header and a RTP header, a FEC packet exceeds MTU size and fragmentation occurs (drawing 13). In order to avoid this, the FEC data of the same size as former data are generated only using a part for the JPEG data division of the data packets (drawing 14). Therefore, the header size which can be added to this FEC data is the same 20 bytes as it of former data, that is, should just design 8 bytes of the same FEC payload header as a JPEG payload header. The approach is explained below.

[0117] First, the header information needed for reconfigurating the original coded data from the data divided into two or more packets by the addressee side is a RTP header:data length, a marker bit, and a time stump RTP. JPEG payload header: It is six, image size, Q value, and offset, and it is necessary to also restore such information in the case of restoration of a ROSUTO packet. Moreover, information required in case a ROSUTO packet is restored using FEC is the sequence number and the number of packets for identifying the packet used for FEC data generation. It is necessary to restore these eight header information.

[0118] First, in such information, within image size, Q value (parameter which directs the compressibility (ratio of the amount of data of the still picture of a dimension, and the still picture after compression) of an image), and the frame same about a time stump, it is fixed, and since it is available, the value of a packet before and after receiving is not included in a header. Next, about offset, since it can restore using these when the data length and marker bit of a packet of order are obtained, it does not include in a header. Therefore, the information with the need of including in a header serves as a sequence number of a data length, a marker bit, and former data, and the number of packets. Since the part of all the packets used for FEC data generation is required for a data length and a marker bit, they include in a header what took such XOR here. The configuration of a FEC payload header is shown in drawing 15 . In addition, the technique of this FEC packet generation is applicable also in the gestalt of the 1st operation.

[0119] Then, the case where hierarchization is performed [approach / of the receiving sequence in the receiving side in the data communication unit concerning the gestalt of operation of the 2nd of this invention / selection] about the frame rate is explained concretely, referring to drawing 16 for an example.

[0120] First, in case reception of an image is started, an addressee receives only fundamental series (step S1601). It is equivalent to the participation to the multicast group by whom fundamental series are transmitted in the case of the multicast, and transmission of the join message of IGMP is used for this. After starting reception of fundamental series, the receiving-side terminal 1002 (addressee) measures the rate of a packet loss for every fixed time amount (step S1602). Since reception by the receive rate which the condition of NO) and a channel is

good and requires mostly at the (step S1603 can be performed when the rate of a packet loss is less than a predetermined threshold, it considers raising an effective receive rate by receiving more data, and it newly [an extended sequence / one] receives (step S1607 - step S1609). In addition, one FEC sequence received when it judges that it judged whether current and a FEC sequence would be received and has received at step S1607 is reduced (step S1608), and it newly [an extended sequence / one] receives (step S1609), and on the other hand, when it judges that it has not received at step S1607, it newly [an extended sequence / one] receives (step S1609).

[0121] Moreover, at this time, when it displays after merging these by the receiving side and performing timing suitably by hierarchizing by the transmitting side so that the frame data of fundamental series may be interpolated by the frame data of an extended sequence, an effective frame rate can be raised. In addition, the time stump added to the packet can be used for the decision of the order of a frame in a merge.

[0122] On the other hand, when the rate of a packet loss which carried out [above-mentioned] measurement exceeds a threshold, YES) and the receive rate to demand are not attained at the (step S1603, but the effectiveness by receiving an extended sequence and raising the receive rate of data becomes weaker. Then, (step S1604 - step S1606), and error resistance can be raised by newly receiving one sequence of FEC data, and an effective receive rate can be raised by restoring the rate of a packet loss. In addition, one extended sequence received when it judges that it judged whether current and an extended sequence would be received and has received at step S1604 is reduced (step S1605), and it newly [a FEC sequence / one] receives (step S1606), and on the other hand, when it judges that it has not received at step S1604, it newly [a FEC sequence / one] receives (step S1609).

[0123] Thus, an addressee can attain suitable receiving quality by changing raising raising a receiving data rate bordering on a certain threshold, and error resistance, and receiving.

[0124] Next, it explains, referring to drawing 17 about the decision approach of the threshold of the above-mentioned rate of a packet loss in the data communication unit concerning the gestalt of operation of the 2nd of this invention.

[0125] As a factor which determines this threshold, a coding method, compressibility, frame size, MTU of a channel, the redundancy of FEC, etc. are mentioned. Here, by the transmitting side, the threshold which corresponds, for example with reference to the table for every coding method as shown in drawing 17 shall be chosen from the parameter which notified parameters, such as frame size, and compressibility, redundancy of FEC, to the receiving side, and was notified in the addressee side as the decision approach. Such a table shall be created based on an actual measurement, simulation, etc. in an actual network, and shall be beforehand prepared for the addressee.

[0126] Next, it explains, referring to drawing 18 about the example of the grouping of the transmitting sequence in the data communication unit concerning the gestalt of operation of the 2nd of this invention.

[0127] In a situation which differ in the range whose bandwidth of the channel to which fundamental series are not restricted to one, a multicast becomes large-scale, and the addressee is connected when carrying out this invention is several figures As shown in drawing 18 , 64kbps(es) for ISDN (Integrated Service Digital Network: Comprehensive Digital Network), Two or more groups for every circuit, such as 384kbps(es) and 10Mbps(es) for LAN, are formed, and a transmit data sequence and an error correction data sequence are hierarchized in each group. And this invention is carried out also by each addressee's performing participation to the group who was suitable for each communication environment beforehand, and choosing the sequence in a group appropriately after that, and receiving.

[0128] As explained above, according to the data communication unit concerning the gestalt of operation of the 2nd of this invention, the transmitting-side terminal 1001 The FEC data generation section 1013 which generates FEC data to the coding equipment 1011 which encodes data hierarchical, and each data encoded hierarchical, the data encoded hierarchical, and FEC data are made into a respectively different data sequence. It has the data transmitting section 1012 and the FEC data transmitting section 1014 which transmit. The receiving-side terminal

1002 Since it has the receiving sequence selection section 1036 which chooses a suitable data sequence based on a receive state out of a respectively different data sequence, the data receive section 1031 which receives the selected data sequence, and the FEC data receive section 1032, following operations and effectiveness are done so.
[0129] In the above-mentioned configuration, for every unit which transmits data into a data sequence, the data transmitting section 1012 of the transmitting-side terminal 1001 adds data transmitting time information (time stump) and the sequence number (sequence number), and transmits. In this case, the data sequences transmitted by the data transmitting section 1012 are the fundamental series according to the hierarchy of coding of data, one or more extended sequences which are the upper layer of these fundamental series, and a FEC data sequence according to the FEC data generated to the data encoded hierarchical.
[0130] At the receiving-side terminal 1002, the rate of a data-loss (rate of a packet loss) is acquired as a receive state. The receiving sequence selection section 1036 of an accepting station 1002 When the rate of a data loss is receiving a FEC data sequence smaller than a predetermined threshold When the received FEC data sequence is reduced, an extended sequence is received further and the rate of a data loss has not received the FEC data sequence smaller than a predetermined threshold Furthermore, when the extended sequence of a high order is received and the rate of a data loss is receiving an extended sequence more greatly than a predetermined threshold When the received extended sequence is reduced, a FEC data sequence is received further and the rate of a data loss has not received the extended sequence more greatly than a predetermined threshold, a FEC data sequence is received further.

[0131] This sets in the gestalt of operation of the 2nd of this invention. When performing data communication to much addressees and coincidence through a network, and each addressee sometimes chooses the rate of grant of a receive rate and FEC data accommodative according to the receiving situation of **** with the communication environment That is, the outstanding effectiveness that good communication link quality is realizable is acquired by choosing the receive rate and error resistance to which each addressee was suitable for each receiving environment. It is effective when distributing real time animation media especially in a multicast environment.
[0132] gestalt] of operation of others [[] -- in the gestalt of the 1st - the 2nd operation of this invention mentioned above, although not specified about a network class, when this invention is applied to large-scale networks, such as the Internet, its effectiveness is large. Moreover, this invention is applicable also to the data communication through various kinds of networks, such as LANs other than the Internet.
[0133] Moreover, in the gestalt of operation of the 1st of this invention mentioned above, although the camera server was raised and explained to the example as a transmitting-side terminal, this invention is not limited by this, either. For example, also when reproducing the animation file memorized by external storage and giving one's service to a client, it can apply.
[0134] Moreover, in the gestalt of operation of the 2nd of this invention mentioned above, as the transmitting-side terminal and the receiving-side terminal were shown in above-mentioned drawing 10 , the case where every one set each connected was raised to the network at the example, but this invention is not limited to the configuration of above-mentioned drawing 10 , and also when arbitration makes two or more set number connection of a transmitting-side terminal and the receiving-side terminal in a network, it can be applied.
[0135] In addition, this invention is not limited only to the equipment and the approach for realizing the above-mentioned operation gestalt, supplies the program code of the software for realizing the above-mentioned operation gestalt to the computer in the above-mentioned system or equipment (CPU or MPU), and also when the computer of the above-mentioned system or equipment operates the various above-mentioned devices according to this program code and it realizes the above-mentioned operation gestalt, it is contained under the category of this invention.
[0136] Moreover, the program code of the above-mentioned software itself will realize the function of the above-mentioned operation gestalt in this case, and the means for supplying that

program code itself and its program code to a computer and the storage which specifically stored the above-mentioned program code are contained under the category of this invention.

[0137] As a storage which stores such a program code, a floppy disk, a hard disk, an optical disk, a magneto-optic disk, CD-ROM, a magnetic tape, the memory card of a non-volatile, ROM, etc. can be used, for example.

[0138] Moreover, not only when the above-mentioned computer controls various devices only according to the supplied program code and the function of the above-mentioned operation gestalt is realized, but when the above-mentioned operation gestalt is realized in collaboration with OS (operating system) to which the above-mentioned program code is working on a computer, or other applications, this program code is contained under the category of this invention.

[0139] Furthermore, after this supplied program code is stored in the memory with which the functional expansion unit connected to the functional add-in board and the computer of a computer is equipped, a part or all of processing that CPU with which that functional add-in board and functional expansion unit are equipped is actual is performed, and also when the above-mentioned operation gestalt is realized by that processing, it is contained under the category of this invention based on directions of that program code.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the block diagram showing the example of a configuration of the data communication unit concerning the gestalt of operation of the 1st of this invention.
[Drawing 2] It is the flow chart which shows the data transmitting processing by the side of the transmit terminal of the data communication unit concerning the gestalt of operation of the 1st of this invention.
[Drawing 3] It is the flow chart which shows the data reception by the side of the accepting station of the data communication unit concerning the gestalt of operation of the 1st of this invention.
[Drawing 4] It is the flow chart which shows receiving layer selection processing with the accepting station of the data communication unit concerning the gestalt of operation of the 1st of this invention.
[Drawing 5] It is the explanatory view showing the transceiver situation of the hierarchized data concerning the gestalt of operation of the 1st of this invention.
[Drawing 6] It is the block diagram showing the example which applied the data communication unit concerning the gestalt of operation of the 1st of this invention to the data telecommunication system.
[Drawing 7] It is the flow chart which shows the data transmitting processing in the camera server of the data telecommunication system concerning the gestalt of operation of the 1st of this invention.
[Drawing 8] It is the flow chart which shows the data reception in the client of the data telecommunication system concerning the gestalt of operation of the 1st of this invention.
[Drawing 9] It is the flow chart which shows the receiving layer modification processing in the client concerning the gestalt of operation of the 1st of this invention.
[Drawing 10] It is the block diagram showing the example of a configuration of the data communication unit concerning the gestalt of operation of the 2nd of this invention.
[Drawing 11] It is the explanatory view showing the configuration of the RTPJPEG payload header concerning the gestalt of operation of the 2nd of this invention.
[Drawing 12] It is the explanatory view showing the configuration of the RTP header concerning the gestalt of operation of the 2nd of this invention.
[Drawing 13] It is the explanatory view showing the case where fragmentation occurs in the FEC data generate time concerning the gestalt of operation of the 2nd of this invention.
[Drawing 14] It is the explanatory view showing the FEC data generation method concerning the gestalt of operation of the 2nd of this invention.
[Drawing 15] It is the explanatory view showing the configuration of the FEC payload header concerning the gestalt of operation of the 2nd of this invention.
[Drawing 16] It is the flow chart which shows the processing which chooses the receiving sequence concerning the gestalt of operation of the 2nd of this invention.
[Drawing 17] It is the explanatory view showing the table for performing threshold selection concerning the gestalt of operation of the 2nd of this invention.
[Drawing 18] It is the explanatory view showing the example of the grouping of the transmitting

sequence concerning the gestalt of operation of the 2nd of this invention.
[Drawing 19] It is the explanatory view showing the example of a configuration of the contents of storage of the storage which memorized the program and associated data of this invention.
[Drawing 20] The program and associated data of this invention are the explanatory view showing the conceptual example supplied to equipment from a storage.
[Description of Notations]
1-1 Transmit Terminal
1-21, 1-22 Accepting station
1-3,300 Network
1-11 Data Generation Section
1-121 Layer 1 transmitting section
1-122 Layer 2 transmitting section
1-123 Layer 3 transmitting section
1-124 Layer 4 transmitting section
1-125 Layer 5 transmitting section
1-211 Data receive section
1-212 Data-processing section
1-213 Receiving layer selection section
1-124 Receiving status monitor section
10 Camera Server
20 Client
100 Camera
103 203 CPU
109 209 Communication interface
208 Display
1001 Transmitting-Side Terminal
1002 Receiving-Side Terminal
1010 Image Capture Equipment
1011 Coding Equipment
1012 Data Transmitting Section
1013 FEC Data Generation Section
1014 FEC Data Transmitting Section
1031 Data Receive Section
1032 FEC Data Receive Section
1033 Error Correction Section
1034 Decode Equipment
1035 Image Display Device
1036 Receiving Sequence Selection Section
1903 Program Execution File
1904 Program Related Data File
2001 Storage

[Translation done.]

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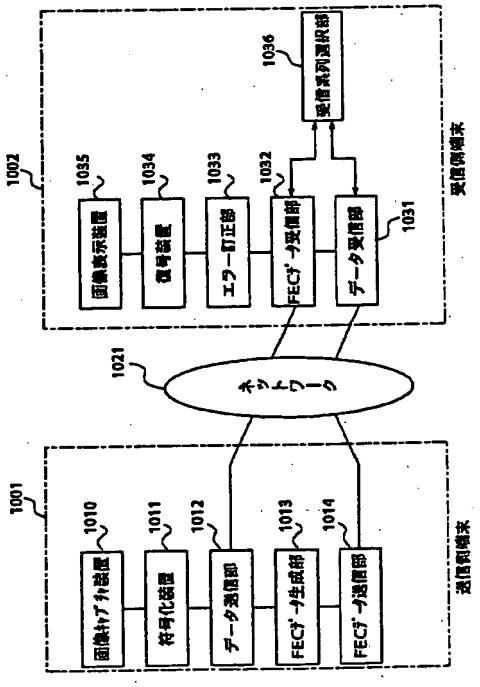
最終頁に続く

(54)【発明の名称】　データ通信システム、データ通信装置、データ通信方法及び記憶媒体

(57)【要約】
【課題】　ネットワークを介して多数の受信者と同時にデータ通信を行う場合に、各受信者がそれぞれの受信環境に適した受信レート及びエラー耐性を選択することにより、良好な通信品質を実現し、特にマルチキャスト環境においてリアルタイムな動画メディアを配信可能としたデータ通信システム、データ通信装置、データ通信方法及び記憶媒体を提供する。
【解決手段】　送信側端末は、データを階層的に符号化する符号化装置１０１１、ＦＥＣデータを生成するＦＥＣデータ生成部１０１３、両データを異なるデータ系列として送信するデータ送信部１０１２、ＦＥＣデータ送信部１０１４を有し、受信側端末は、受信状態に基づき適切なデータ系列を選択する受信系列選択部１０３６、選択したデータ系列を受信するデータ受信部１０３１、ＦＥＣデータ受信部１０３２を有する。



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【特許請求の範囲】

【請求項１】　送信側のデータ通信装置及び複数の受信側のデータ通信装置との間でネットワークを介してデータの送受信を行うデータ通信システムであって、

前記送信側のデータ通信装置は、前記データを階層的に符号化して符号化データを生成する符号化手段と、該符号化手段で階層的に符号化されたそれぞれの符号化データに対しエラー訂正用のデータを生成する訂正用データ生成手段と、前記階層的に符号化された符号化データと前記エラー訂正用のデータとを各々異なるデータ系列として送信する送信手段とを有し、

前記受信側のデータ通信装置は、前記各々異なるデータ系列の中から受信状態に基づいて適切なデータ系列を選択する選択手段と、該選択手段で選択したデータ系列を受信する受信手段とを有することを特徴とするデータ通信システム。

【請求項２】　前記送信手段により送信するデータ系列は、前記データの符号化の階層に応じた基本系列、該基本系列の上位層である１つ以上の拡張系列、及び前記階層的に符号化されたデータに対して生成された各訂正用データに応じた訂正用データ系列であることを特徴とする請求項１記載のデータ通信システム。

【請求項３】　前記基本系列は、前記選択手段により前記データ系列の中から必ず選択されることを特徴とする請求項２記載のデータ通信システム。

【請求項４】　更に、前記送信側のデータ通信装置は、前記符号化手段で階層的に符号化された符号化データをパケット化してデータパケットを生成するデータパケット化手段と、前記エラー訂正用のデータを用いてエラー訂正用パケットを生成する訂正用データパケット化手段とを有し、前記訂正用データ生成手段は、前記データパケットを用いて前記エラー訂正用のデータを生成し、前記送信手段は、前記データパケットと前記エラー訂正用パケットとをそれぞれ前記符号化データのデータ系列と前記エラー訂正用のデータのデータ系列として送信することを特徴とする請求項１記載のデータ通信システム。

【請求項５】　前記送信手段は、前記データ系列内のデータパケット毎にデータ送信時刻情報及び順序番号を付加して送信することを特徴とする請求項４記載のデータ通信システム。

【請求項６】　前記訂正用データ生成手段は、前記階層的に符号化されたデータのデータパケットを参照し該データパケットの符号化データ部分だけを用いて前記エラー訂正用のデータを生成し、前記訂正用データパケット化手段は、エラー訂正時に最低限必要な情報のみを含むペイロードヘッダを生成し、前記エラー訂正用のデータと前記ペイロードヘッダを用いて前記エラー訂正用パケットを生成することを特徴とする請求項４記載のデータ通信システム。

【請求項７】　前記受信側のデータ通信装置は、更に、

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前記受信状態を取得する状態取得手段を有することを特徴とする請求項１記載のデータ通信システム。

【請求項８】　前記状態取得手段は、前記受信状態としてデータ損失率、送信レート、受信レートを取得することを特徴とする請求項７記載のデータ通信システム。

【請求項９】　前記選択手段は、前記データ損失率が所定の閾値より小さく前記送信レートと前記受信レートとの比が所定の閾値より大きい場合は更に上位層の符号化データのデータ系列である拡張系列を受信し、前記データ損失率が所定の閾値より小さく前記送信レートと前記受信レートとの比が所定の閾値より小さい場合は受信している訂正用のデータ系列を減らし、前記データ損失率が所定の閾値より大きく前記送信レートと前記受信レートとの比が所定の閾値より大きい場合は訂正用のデータ系列を更に受信し、前記データ損失率が所定の閾値より大きく前記送信レートと前記受信レートとの比が所定の閾値より小さい場合は受信する拡張系列を上位層から順に減らすことを特徴とする請求項８記載のデータ通信システム。

【請求項１０】　前記状態取得手段は、前記受信状態としてデータ損失率を取得することを特徴とする請求項７記載のデータ通信システム。

【請求項１１】　前記選択手段は、前記データ損失率が所定の閾値より小さく前記エラー訂正用のデータ系列を受信中の場合は、受信しているエラー訂正用のデータ系列を減らして更に上位層の符号化データのデータ系列である拡張系列を受信し、前記データ損失率が所定の閾値より小さく前記エラー訂正用のデータ系列を受信していない場合は、更に上位層の符号化データのデータ系列である拡張系列を受信し、前記データ損失率が所定の閾値より大きく拡張系列を受信中の場合は、受信している拡張系列を減らして前記エラー訂正用のデータ系列を更に受信し、前記データ損失率が所定の閾値より大きく拡張系列を受信していない場合は、前記エラー訂正用のデータ系列を更に受信することを特徴とする請求項１０記載のデータ通信システム。

【請求項１２】　前記所定の閾値は、前記符号化データの符号化方式に応じて決定されることを特徴とする請求項９又は１１記載のデータ通信システム。

【請求項１３】　前記送信側のデータ通信装置からインターネット等のネットワークを介して複数の受信側のデータ通信装置に動画像等のデータを同報するマルチキャスト通信に適用可能であることを特徴とする請求項１乃至１２の何れかに記載のデータ通信システム。

【請求項１４】　複数の受信側のデータ通信装置に対しネットワークを介してデータの送信を行うデータ通信装置であって、

前記データを階層的に符号化して符号化データを生成する符号化手段と、該符号化手段で階層的に符号化されたそれぞれの符号化データに対しエラー訂正用のデータを

生成する訂正用データ生成手段と、前記階層的に符号化された符号化データと前記エラー訂正用のデータとを各々異なるデータ系列として送信する送信手段とを有することを特徴とするデータ通信装置。

【請求項１５】　前記送信手段により送信するデータ系列は、前記データの符号化の階層に応じた基本系列、該基本系列の上位層である１つ以上の拡張系列、及び前記階層的に符号化されたデータに対して生成された各訂正用データに応じた訂正用データ系列であることを特徴とする請求項１４記載のデータ通信装置。

【請求項１６】　前記基本系列は、前記受信側のデータ通信装置により前記データ系列の中から必ず選択されることを特徴とする請求項１５記載のデータ通信装置。

【請求項１７】　更に、前記符号化手段で階層的に符号化された符号化データをパケット化してデータパケットを生成するデータパケット化手段と、前記エラー訂正用のデータを用いてエラー訂正用パケットを生成する訂正用データパケット化手段とを有し、前記訂正用データ生成手段は、前記データパケットを用いて前記エラー訂正用のデータを生成し、前記送信手段は、前記データパケットと前記エラー訂正用パケットとをそれぞれ前記符号化データのデータ系列と前記エラー訂正用のデータのデータ系列として送信することを特徴とする請求項１４記載のデータ通信装置。

【請求項１８】　前記送信手段は、前記データ系列内のデータパケット毎にデータ送信時刻情報及び順序番号を付加して送信することを特徴とする請求項１７記載のデータ通信装置。

【請求項１９】　前記訂正用データ生成手段は、前記階層的に符号化されたデータのデータパケットを参照し該データパケットの符号化データ部分だけを用いて前記エラー訂正用のデータを生成し、前記訂正用データパケット化手段は、エラー訂正時に最低限必要な情報のみを含むペイロードヘッダを生成し、前記エラー訂正用のデータと前記ペイロードヘッダを用いて前記エラー訂正用パケットを生成することを特徴とする請求項１７記載のデータ通信装置。

【請求項２０】　インターネット等のネットワークを介して複数の受信側のデータ通信装置に動画像等のデータを同報するマルチキャスト通信に適用可能であることを特徴とする請求項１４乃至１９の何れかに記載のデータ通信装置。

【請求項２１】　送信側のデータ通信装置からネットワークを介してデータの受信を行うデータ通信装置であって、

前記送信側のデータ通信装置から送信されてくるデータ系列の中から受信状態に基づいて適切なデータ系列を選択する選択手段と、該選択手段で選択したデータ系列を受信する受信手段とを有することを特徴とするデータ通信装置。

【請求項２２】　前記送信側のデータ通信装置から送信されてくるデータ系列は、前記データの符号化の階層に応じた基本系列、該基本系列の上位層である１つ以上の拡張系列、及び前記階層的に符号化されたデータに対して生成された各訂正用データに応じた訂正用データ系列であることを特徴とする請求項２１記載のデータ通信装置。

【請求項２３】　前記基本系列は、前記選択手段により前記データ系列の中から必ず選択されることを特徴とする請求項２２記載のデータ通信装置。

【請求項２４】　更に、前記受信状態を取得する状態取得手段を有することを特徴とする請求項２１記載のデータ通信装置。

【請求項２５】　前記状態取得手段は、前記受信状態としてデータ損失率、送信レート、受信レートを取得することを特徴とする請求項２４記載のデータ通信装置。

【請求項２６】　前記選択手段は、前記データ損失率が所定の閾値より小さく前記送信レートと前記受信レートとの比が所定の閾値より大きい場合は更に上位層の符号化データのデータ系列である拡張系列を受信し、前記データ損失率が所定の閾値より小さく前記送信レートと前記受信レートとの比が所定の閾値より小さい場合は受信している訂正用のデータ系列を減らし、前記データ損失率が所定の閾値より大きく前記送信レートと前記受信レートとの比が所定の閾値より大きい場合は訂正用のデータ系列を更に受信し、前記データ損失率が所定の閾値より大きく前記送信レートと前記受信レートとの比が所定の閾値より小さい場合は受信する拡張系列を上位層から順に減らすことを特徴とする請求項２５記載のデータ通信装置。

【請求項２７】　前記状態取得手段は、前記受信状態としてデータ損失率を取得することを特徴とする請求項２４記載のデータ通信装置。

【請求項２８】　前記選択手段は、前記データ損失率が所定の閾値より小さく前記エラー訂正用のデータ系列を受信中の場合は、受信しているエラー訂正用のデータ系列を減らして更に上位層の符号化データのデータ系列である拡張系列を受信し、前記データ損失率が所定の閾値より小さく前記エラー訂正用のデータ系列を受信していない場合は、更に上位層の符号化データのデータ系列である拡張系列を受信し、前記データ損失率が所定の閾値より大きく拡張系列を受信中の場合は、受信している拡張系列を減らして前記エラー訂正用のデータ系列を更に受信し、前記データ損失率が所定の閾値より大きく拡張系列を受信していない場合は、前記エラー訂正用のデータ系列を更に受信することを特徴とする請求項２７記載のデータ通信装置。

【請求項２９】　前記所定の閾値は、前記符号化データの符号化方式に応じて決定されることを特徴とする請求項２６又は２８記載のデータ通信装置。

【請求項３０】　前記送信側のデータ通信装置からインターネット等のネットワークを介して動画像等のデータが同報されるマルチキャスト通信に適用可能であることを特徴とする請求項２１乃至２９の何れかに記載のデータ通信装置。

【請求項３１】　送信側のデータ通信装置及び複数の受信側のデータ通信装置との間でネットワークを介してデータの送受信を行うデータ通信システムに適用されるデータ通信方法であって、

前記送信側のデータ通信装置は、前記データを階層的に符号化して符号化データを生成する符号化ステップと、該符号化ステップで階層的に符号化されたそれぞれの符号化データに対しエラー訂正用のデータを生成する訂正用データ生成ステップと、前記階層的に符号化された符号化データと前記エラー訂正用のデータとを各々異なるデータ系列として送信する送信ステップとを有し、

前記受信側のデータ通信装置は、前記各々異なるデータ系列の中から受信状態に基づいて適切なデータ系列を選択する選択ステップと、該選択ステップで選択したデータ系列を受信する受信ステップとを有することを特徴とするデータ通信方法。

【請求項３２】　前記送信ステップで送信するデータ系列は、前記データの符号化の階層に応じた基本系列、該基本系列の上位層である１つ以上の拡張系列、及び前記階層的に符号化されたデータに対して生成された各訂正用データに応じた訂正用データ系列であることを特徴とする請求項３１記載のデータ通信方法。

【請求項３３】　前記基本系列は、前記選択ステップにおいて前記データ系列の中から必ず選択されることを特徴とする請求項３２記載のデータ通信方法。

【請求項３４】　更に、前記送信側のデータ通信装置は、前記符号化ステップで階層的に符号化された符号化データをパケット化してデータパケットを生成するデータパケット化ステップと、前記エラー訂正用のデータを用いてエラー訂正用パケットを生成する訂正用データパケット化ステップとを有し、前記訂正用データ生成ステップでは、前記データパケットを用いて前記エラー訂正用のデータを生成し、前記送信ステップでは、前記データパケットと前記エラー訂正用パケットとをそれぞれ前記符号化データのデータ系列と前記エラー訂正用のデータのデータ系列として送信することを特徴とする請求項３１記載のデータ通信方法。

【請求項３５】　前記送信ステップでは、前記データ系列内のデータパケット毎にデータ送信時刻情報及び順序番号を付加して送信することを特徴とする請求項３４記載のデータ通信方法。

【請求項３６】　前記訂正用データ生成ステップでは、前記階層的に符号化されたデータのデータパケットを参照し該データパケットの符号化データ部分だけを用いて前記エラー訂正用のデータを生成し、前記訂正用データパケット化ステップでは、エラー訂正時に最低限必要な情報のみを含むペイロードヘッダを生成し、前記エラー訂正用のデータと前記ペイロードヘッダを用いて前記エラー訂正用パケットを生成することを特徴とする請求項３４記載のデータ通信方法。

【請求項３７】　前記受信側のデータ通信装置は、更に、前記受信状態を取得する状態取得ステップを有することを特徴とする請求項３１記載のデータ通信方法。

【請求項３８】　前記状態取得ステップでは、前記受信状態としてデータ損失率、送信レート、受信レートを取得することを特徴とする請求項３７記載のデータ通信方法。

【請求項３９】　前記選択ステップでは、前記データ損失率が所定の閾値より小さく前記送信レートと前記受信レートとの比が所定の閾値より大きい場合は更に上位層の符号化データのデータ系列である拡張系列を受信し、前記データ損失率が所定の閾値より小さく前記送信レートと前記受信レートとの比が所定の閾値より小さい場合は受信している訂正用のデータ系列を減らし、前記データ損失率が所定の閾値より大きく前記送信レートと前記受信レートとの比が所定の閾値より大きい場合は訂正用のデータ系列を更に受信し、前記データ損失率が所定の閾値より大きく前記送信レートと前記受信レートとの比が所定の閾値より小さい場合は受信する拡張系列を上位層から順に減らすことを特徴とする請求項３８記載のデータ通信方法。

【請求項４０】　前記状態取得ステップでは、前記受信状態としてデータ損失率を取得することを特徴とする請求項３７記載のデータ通信方法。

【請求項４１】　前記選択ステップでは、前記データ損失率が所定の閾値より小さく前記エラー訂正用のデータ系列を受信中の場合は、受信しているエラー訂正用のデータ系列を減らして更に上位層の符号化データのデータ系列である拡張系列を受信し、前記データ損失率が所定の閾値より小さく前記エラー訂正用のデータ系列を受信していない場合は、更に上位層の符号化データのデータ系列である拡張系列を受信し、前記データ損失率が所定の閾値より大きく拡張系列を受信中の場合は、受信している拡張系列を減らして前記エラー訂正用のデータ系列を更に受信し、前記データ損失率が所定の閾値より大きく拡張系列を受信していない場合は、前記エラー訂正用のデータ系列を更に受信することを特徴とする請求項４０記載のデータ通信方法。

【請求項４２】　前記所定の閾値は、前記符号化データの符号化方式に応じて決定されることを特徴とする請求項３９又は４１記載のデータ通信方法。

【請求項４３】　前記送信側のデータ通信装置からインターネット等のネットワークを介して複数の受信側のデータ通信装置に動画像等のデータを同報するマルチキャスト通信に適用可能であることを特徴とする請求項３１

乃至４２の何れかに記載のデータ通信方法。

【請求項４４】　送信側のデータ通信装置及び複数の受信側のデータ通信装置との間でネットワークを介してデータの送受信を行うデータ通信システムに適用されるデータ通信方法を実行するプログラムを記憶したコンピュータにより読み出し可能な記憶媒体であって、

前記データ通信方法は、前記データを階層的に符号化して符号化データを生成する符号化ステップと、該符号化ステップで階層的に符号化されたそれぞれの符号化データに対しエラー訂正用のデータを生成する訂正用データ生成ステップと、前記階層的に符号化された符号化データと前記エラー訂正用のデータとを各々異なるデータ系列として送信するように制御する送信ステップと、前記各々異なるデータ系列の中から受信状態に基づいて適切なデータ系列を選択する選択ステップと、該選択ステップで選択したデータ系列を受信するように制御する受信ステップとを有することを特徴とする記憶媒体。

【請求項４５】　前記送信ステップで送信制御するデータ系列は、前記データの符号化の階層に応じた基本系列、該基本系列の上位層である１つ以上の拡張系列、及び前記階層的に符号化されたデータに対して生成された各訂正用データに応じた訂正用データ系列であることを特徴とする請求項４４記載の記憶媒体。

【請求項４６】　前記基本系列は、前記選択ステップにおいて前記データ系列の中から必ず選択されることを特徴とする請求項４５記載の記憶媒体。

【請求項４７】　更に、前記符号化ステップで階層的に符号化された符号化データをバケット化してデータバケットを生成するデータバケット化ステップと、前記エラー訂正用のデータを用いてエラー訂正用バケットを生成する訂正用データバケット化ステップとを有し、前記訂正用データ生成ステップでは、前記データバケットを用いて前記エラー訂正用のデータを生成し、前記送信ステップでは、前記データバケットと前記エラー訂正用バケットとをそれぞれ前記符号化データのデータ系列と前記エラー訂正用のデータのデータ系列として送信するように制御することを特徴とする請求項４４記載の記憶媒体。

【請求項４８】　前記送信ステップでは、前記データ系列内のデータバケット毎にデータ送信時刻情報及び順序番号を付加して送信するように制御することを特徴とする請求項４７記載の記憶媒体。

【請求項４９】　前記訂正用データ生成ステップでは、前記階層的に符号化されたデータのデータバケットを参照し該データバケットの符号化データ部分だけを用いて前記エラー訂正用のデータを生成し、前記訂正用データバケット化ステップでは、エラー訂正時に最低限必要な情報のみを含むペイロードヘッダを生成し、前記エラー訂正用のデータと前記ペイロードヘッダを用いて前記エラー訂正用バケットを生成することを特徴とする請求項４７記載の記憶媒体。

【請求項５０】　更に、前記受信状態を取得する状態取得ステップを有することを特徴とする請求項４４記載の記憶媒体。

【請求項５１】　前記状態取得ステップでは、前記受信状態としてデータ損失率、送信レート、受信レートを取得することを特徴とする請求項５０記載の記憶媒体。

【請求項５２】　前記選択ステップでは、前記データ損失率が所定の閾値より小さく前記送信レートと前記受信レートとの比が所定の閾値より大きい場合は更に上位層の符号化データのデータ系列である拡張系列を受信するように制御し、前記データ損失率が所定の閾値より小さく前記送信レートと前記受信レートとの比が所定の閾値より小さい場合は受信している訂正用のデータ系列を減らし、前記データ損失率が所定の閾値より大きく前記送信レートと前記受信レートとの比が所定の閾値より大きい場合は訂正用のデータ系列を更に受信するように制御し、前記データ損失率が所定の閾値より大きく前記送信レートと前記受信レートとの比が所定の閾値より小さい場合は受信する拡張系列を上位層から順に減らすことを特徴とする請求項５１記載の記憶媒体。

【請求項５３】　前記状態取得ステップでは、前記受信状態としてデータ損失率を取得することを特徴とする請求項５０記載の記憶媒体。

【請求項５４】　前記選択ステップでは、前記データ損失率が所定の閾値より小さく前記エラー訂正用のデータ系列を受信中の場合は、受信しているエラー訂正用のデータ系列を減らして更に上位層の符号化データのデータ系列である拡張系列を受信するように制御し、前記データ損失率が所定の閾値より小さく前記エラー訂正用のデータ系列を受信していない場合は、更に上位層の符号化データのデータ系列である拡張系列を受信するように制御し、前記データ損失率が所定の閾値より大きく拡張系列を受信中の場合は、受信している拡張系列を減らして前記エラー訂正用のデータ系列を更に受信するように制御し、前記データ損失率が所定の閾値より大きく拡張系列を受信していない場合は、前記エラー訂正用のデータ系列を更に受信するように制御することを特徴とする請求項５３記載の記憶媒体。

【請求項５５】　前記所定の閾値は、前記符号化データの符号化方式に応じて決定されることを特徴とする請求項５２又は５４記載の記憶媒体。

【請求項５６】　前記送信側のデータ通信装置からインターネット等のネットワークを介して複数の受信側のデータ通信装置に動画像等のデータを同報するマルチキャスト通信に適用可能であることを特徴とする請求項４４乃至５５の何れかに記載の記憶媒体。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、データ通信システ

ム、データ通信装置、データ通信方法及び記憶媒体に関し、更に詳しくは、映像や音声といった定常的に発生するデータをネットワークを通じてリアルタイムな送信／受信を行う場合に好適なデータ通信システム、データ通信装置、データ通信方法及び記憶媒体に関する。

【０００２】

【従来の技術】一般に、インターネットのような品質非保証のネットワークにおいてデータ通信を行う場合、ネットワークで生じたエラーによるデータ損失は避けられない。特に、Ｈ．２６３（フルカラー動画像符号化方式の国際標準）やＭＰＥＧ（Moving Picture Experts Group：フルカラー動画像圧縮方式）などの差分コーデックによって圧縮された動画像を転送する場合、データ損失の影響は画像の空間、時間方向にも伝播するため、送信レートの制御とは別の問題としてエラーへの対応が重要な課題となっている。

【０００３】このデータ損失を修復するための手段として、Forward Error Correction（ＦＥＣ：自動誤り訂正方式）という手法が考えられている。これは、誤り訂正を行うためのデータ（ＦＥＣデータ）を予め冗長に送信し、実際にネットワークでエラーが発生した場合はこのＦＥＣデータを利用して損失したデータの修復を行うものであり、損失データの再送などを行う方式に比べてエラー修復に要する遅延時間を比較的低く抑えることができる点で特に動画像のリアルタイムな通信に適していると考えられる。ＦＥＣの利用法としては、ＩＥＴＦ（Internet Engineering Task Force：インターネット特別技術調査委員会）によるInternet Draft（An RTP Payload Format for Generic Forward Error Correction）が提案されている。

【０００４】この場合にＦＥＣのデータ量をどの程度付加するかは、ネットワークの状況によって異なってくる。そこで、ネットワークの状況によって、ＦＥＣのための冗長なデータ量を調整する手法が考案されている。このような技術は、多数の端末が存在しても一種類のデータした送信しないということを前提になされたものである。しかし、受信端末が多数存在する状況下では、受信端末毎に最適にエラー訂正データ量を調整することが望まれる。

【０００５】

【発明が解決しようとする課題】一方、ネットワークを介して、複数の受信端末に映像音声といった連続メディアをリアルタイムに同時に送信する時、送信するメディアの品質が問題となってくる。特に各受信端末のネットワーク環境が異なる場合には、広帯域のネットワークで接続された端末に合わせて高品質なメディアを送信すべきか、低品質のメディアしか受信できる能力のない端末に品質を調整するべきかという問題が生じる。そこで、階層化してメディアデータを圧縮し、それぞれの階層を別のストリームで送信する手法が提案されている。基本となる階層のみ受信しても最低限の品質のデータを受信することができ、より上の層のデータストリーム（データ系列）に順々に加わり受信することで、徐々に高品質のメディアを受信できるようになる。

【０００６】このように、送受信間の有効帯域が狭い受信端末は、基本となる下位レイヤのストリームだけを受信し最低限の品質が得られ、広帯域のネットワークを持つ受信端末は高品質なメディアが再生できる上位レイヤのストリームまで受信し高品質なメディアが得られるという手法が考案されている。このような手法では、品質が様々に異なるデータを複数の受信端末に適応的に送信することができる。更に、伝送路の信頼性が異なるネットワークに対応するには、受信端末毎のネットワーク状況に応じてエラー訂正データの付加量も調整することが望ましい。

【０００７】ところで、インターネットのように異なる通信方式のネットワーク（イーサネット（米国ゼロックス・ＤＥＣ・インテル三社が共同開発したバス構造のＬＡＮ）、ＩＳＤＮ（Integrated Service Digital Network：総合デジタル通信網）、モデムなど）が途中に混在し、且つ途中のノードに様々なデータが流入するネットワークにおいて、マルチキャスト（１つのパケットで複数の端末に対して同一データを送信する方式）のような同報システムが普及してきている。このような状況において、多数の受信端末に同時に映像音声といった連続メディアをリアルタイムに伝送する場合、受信端末毎のネットワークの接続形態や外部トラヒックの量などに応じて、最適な品質及び最適なエラー耐性を考慮したデータ送信法を実現する必要がある。

【０００８】上述した如くネットワークを介して多数の受信者に動画像などのメディアデータを同報するマルチキャスト通信が普及し始めているが、このような通信を行う場合、受信者間で大きく異なる通信環境への対応が問題となる。即ち、十分な帯域幅を持って接続している受信者に合わせて高レートで送信を行えば、狭帯域幅で接続された受信者の通信路に過剰なデータが流れ込み輻輳が生じ、逆に低速回線に合わせて低レートでの送信を行えば、広帯域の受信者が帯域幅を利用し切れなくなるという問題である。この問題に対応するために、送信側では階層化された複数の送信データ系列（データストリーム）を送信し、受信者側でこれらデータ系列の中から適切な系列のみを選択して受信する方法が提案されている。これにより、広帯域を利用できる受信者は高レート或いは多数の系列を受信し、また狭帯域線で接続される受信者は低レート或いは少数の系列のみを受信することで、個々の受信者がそれぞれ適切な受信レートでの通信を実現することができる。

【０００９】ところで、マルチキャストのように受信者間での通信環境が大きく異なる場合には、エラーの発生状況もまた受信者ごとに異なり、従って受信レートだけ

ではなく、保証されるエラー耐性の程度もまた通信環境に応じて受信者が選択できることが、良好な通信品質を実現するために必要となってくる。

【００１０】本発明は、上述した点に鑑みなされたものであり、ネットワークを介して多数の受信者と同時にデータ通信を行う場合に、各受信者がそれぞれの受信環境に適した受信レート及びエラー耐性を選択することにより、良好な通信品質を実現し、特にマルチキャスト環境においてリアルタイムな動画メディアを配信可能としたデータ通信システム、データ通信装置、データ通信方法及び記憶媒体を提供することを目的とする。

【００１１】

【課題を解決するための手段】上記目的を達成するために、請求項１記載の発明は、送信側のデータ通信装置及び複数の受信側のデータ通信装置との間でネットワークを介してデータの送受信を行うデータ通信システムであって、前記送信側のデータ通信装置は、前記データを階層的に符号化して符号化データを生成する符号化手段と、該符号化手段で階層的に符号化されたそれぞれの符号化データに対しエラー訂正用のデータを生成する訂正用データ生成手段と、前記階層的に符号化された符号化データと前記エラー訂正用のデータとを各々異なるデータ系列として送信する送信手段とを有し、前記受信側のデータ通信装置は、前記各々異なるデータ系列の中から受信状態に基づいて適切なデータ系列を選択する選択手段と、該選択手段で選択したデータ系列を受信する受信手段とを有することを特徴とする。

【００１２】上記目的を達成するために、請求項２記載の発明は、前記送信手段により送信するデータ系列は、前記データの符号化の階層に応じた基本系列、該基本系列の上位層である１つ以上の拡張系列、及び前記階層的に符号化されたデータに対して生成された各訂正用データに応じた訂正用データ系列であることを特徴とする。

【００１３】上記目的を達成するために、請求項３記載の発明は、前記基本系列は、前記選択手段により前記データ系列の中から必ず選択されることを特徴とする。

【００１４】上記目的を達成するために、請求項４記載の発明は、更に、前記送信側のデータ通信装置は、前記符号化手段で階層的に符号化された符号化データをパケット化してデータパケットを生成するデータパケット化手段と、前記エラー訂正用のデータを用いてエラー訂正用パケットを生成する訂正用データパケット化手段とを有し、前記訂正用データ生成手段は、前記データパケットを用いて前記エラー訂正用のデータを生成し、前記送信手段は、前記データパケットと前記エラー訂正用パケットとをそれぞれ前記符号化データのデータ系列と前記エラー訂正用のデータのデータ系列として送信することを特徴とする。

【００１５】上記目的を達成するために、請求項５記載の発明は、前記送信手段は、前記データ系列内のデータパケット毎にデータ送信時刻情報及び順序番号を付加して送信することを特徴とする。

【００１６】上記目的を達成するために、請求項６記載の発明は、前記訂正用データ生成手段は、前記階層的に符号化されたデータのデータパケットを参照し該データパケットの符号化データ部分だけを用いて前記エラー訂正用のデータを生成し、前記訂正用データパケット化手段は、エラー訂正時に最低限必要な情報のみを含むペイロードヘッダを生成し、前記エラー訂正用のデータと前記ペイロードヘッダを用いて前記エラー訂正用パケットを生成することを特徴とする。

【００１７】上記目的を達成するために、請求項７記載の発明は、前記受信側のデータ通信装置は、更に、前記受信状態を取得する状態取得手段を有することを特徴とする。

【００１８】上記目的を達成するために、請求項８記載の発明は、前記状態取得手段は、前記受信状態としてデータ損失率、送信レート、受信レートを取得することを特徴とする。

【００１９】上記目的を達成するために、請求項９記載の発明は、前記選択手段は、前記データ損失率が所定の閾値より小さく前記送信レートと前記受信レートとの比が所定の閾値より大きい場合は更に上位層の符号化データのデータ系列である拡張系列を受信し、前記データ損失率が所定の閾値より小さく前記送信レートと前記受信レートとの比が所定の閾値より小さい場合は受信している訂正用のデータ系列を減らし、前記データ損失率が所定の閾値より大きく前記送信レートと前記受信レートとの比が所定の閾値より大きい場合は訂正用のデータ系列を更に受信し、前記データ損失率が所定の閾値より大きく前記送信レートと前記受信レートとの比が所定の閾値より小さい場合は受信する拡張系列を上位層から順に減らすことを特徴とする。

【００２０】上記目的を達成するために、請求項１０記載の発明は、前記状態取得手段は、前記受信状態としてデータ損失率を取得することを特徴とする。

【００２１】上記目的を達成するために、請求項１１記載の発明は、前記選択手段は、前記データ損失率が所定の閾値より小さく前記エラー訂正用のデータ系列を受信中の場合は、受信しているエラー訂正用のデータ系列を減らして更に上位層の符号化データのデータ系列である拡張系列を受信し、前記データ損失率が所定の閾値より小さく前記エラー訂正用のデータ系列を受信していない場合は、更に上位層の符号化データのデータ系列である拡張系列を受信し、前記データ損失率が所定の閾値より大きく拡張系列を受信中の場合は、受信している拡張系列を減らして前記エラー訂正用のデータ系列を更に受信し、前記データ損失率が所定の閾値より大きく拡張系列を受信していない場合は、前記エラー訂正用のデータ系列を更に受信することを特徴とする。

【００２２】上記目的を達成するために、請求項１２記載の発明は、前記所定の閾値は、前記符号化データの符号化方式に応じて決定されることを特徴とする。

【００２３】上記目的を達成するために、請求項１３記載の発明は、前記送信側のデータ通信装置からインターネット等のネットワークを介して複数の受信側のデータ通信装置に動画像等のデータを同報するマルチキャスト通信に適用可能であることを特徴とする。

【００２４】上記目的を達成するために、請求項１４記載の発明は、複数の受信側のデータ通信装置に対しネットワークを介してデータの送信を行うデータ通信装置であって、前記データを階層的に符号化して符号化データを生成する符号化手段と、該符号化手段で階層的に符号化されたそれぞれの符号化データに対しエラー訂正用のデータを生成する訂正用データ生成手段と、前記階層的に符号化された符号化データと前記エラー訂正用のデータとを各々異なるデータ系列として送信する送信手段とを有することを特徴とする。

【００２５】上記目的を達成するために、請求項１５記載の発明は、前記送信手段により送信するデータ系列は、前記データの符号化の階層に応じた基本系列、該基本系列の上位層である１つ以上の拡張系列、及び前記階層的に符号化されたデータに対して生成された各訂正用データに応じた訂正用データ系列であることを特徴とする。

【００２６】上記目的を達成するために、請求項１６記載の発明は、前記基本系列は、前記受信側のデータ通信装置により前記データ系列の中から必ず選択されることを特徴とする。

【００２７】上記目的を達成するために、請求項１７記載の発明は、更に、前記符号化手段で階層的に符号化された符号化データをパケット化してデータパケットを生成するデータパケット化手段と、前記エラー訂正用のデータを用いてエラー訂正用パケットを生成する訂正用データパケット化手段とを有し、前記訂正用データ生成手段は、前記データパケットを用いて前記エラー訂正用のデータを生成し、前記送信手段は、前記データパケットと前記エラー訂正用パケットとをそれぞれ前記符号化データのデータ系列と前記エラー訂正用のデータのデータ系列として送信することを特徴とする。

【００２８】上記目的を達成するために、請求項１８記載の発明は、前記送信手段は、前記データ系列内のデータパケット毎にデータ送信時刻情報及び順序番号を付加して送信することを特徴とする。

【００２９】上記目的を達成するために、請求項１９記載の発明は、前記訂正用データ生成手段は、前記階層的に符号化されたデータのデータパケットを参照し該データパケットの符号化データ部分だけを用いて前記エラー訂正用のデータを生成し、前記訂正用データパケット化手段は、エラー訂正時に最低限必要な情報のみを含むペイロードヘッダを生成し、前記エラー訂正用のデータと前記ペイロードヘッダを用いて前記エラー訂正用パケットを生成することを特徴とする。

【００３０】上記目的を達成するために、請求項２０記載の発明は、インターネット等のネットワークを介して複数の受信側のデータ通信装置に動画像等のデータを同報するマルチキャスト通信に適用可能であることを特徴とする。

【００３１】上記目的を達成するために、請求項２１記載の発明は、送信側のデータ通信装置からネットワークを介してデータの受信を行うデータ通信装置であって、前記送信側のデータ通信装置から送信されてくるデータ系列の中から受信状態に基づいて適切なデータ系列を選択する選択手段と、該選択手段で選択したデータ系列を受信する受信手段とを有することを特徴とする。

【００３２】上記目的を達成するために、請求項２２記載の発明は、前記送信側のデータ通信装置から送信されてくるデータ系列は、前記データの符号化の階層に応じた基本系列、該基本系列の上位層である１つ以上の拡張系列、及び前記階層的に符号化されたデータに対して生成された各訂正用データに応じた訂正用データ系列であることを特徴とする。

【００３３】上記目的を達成するために、請求項２３記載の発明は、前記基本系列は、前記選択手段により前記データ系列の中から必ず選択されることを特徴とする。

【００３４】上記目的を達成するために、請求項２４記載の発明は、更に、前記受信状態を取得する状態取得手段を有することを特徴とする。

【００３５】上記目的を達成するために、請求項２５記載の発明は、前記状態取得手段は、前記受信状態としてデータ損失率、送信レート、受信レートを取得することを特徴とする。

【００３６】上記目的を達成するために、請求項２６記載の発明は、前記選択手段は、前記データ損失率が所定の閾値より小さく前記送信レートと前記受信レートとの比が所定の閾値より大きい場合は更に上位層の符号化データのデータ系列である拡張系列を受信し、前記データ損失率が所定の閾値より小さく前記送信レートと前記受信レートとの比が所定の閾値より小さい場合は受信している訂正用のデータ系列を減らし、前記データ損失率が所定の閾値より大きく前記送信レートと前記受信レートとの比が所定の閾値より大きい場合は訂正用のデータ系列を更に受信し、前記データ損失率が所定の閾値より大きく前記送信レートと前記受信レートとの比が所定の閾値より小さい場合は受信する拡張系列を上位層から順に減らすことを特徴とする。

【００３７】上記目的を達成するために、請求項２７記載の発明は、前記状態取得手段は、前記受信状態としてデータ損失率を取得することを特徴とする。

【００３８】上記目的を達成するために、請求項２８記

載の発明は、前記選択手段は、前記データ損失率が所定の閾値より小さく前記エラー訂正用のデータ系列を受信中の場合は、受信しているエラー訂正用のデータ系列を減らして更に上位層の符号化データのデータ系列である拡張系列を受信し、前記データ損失率が所定の閾値より小さく前記エラー訂正用のデータ系列を受信していない場合は、更に上位層の符号化データのデータ系列である拡張系列を受信し、前記データ損失率が所定の閾値より大きく拡張系列を受信中の場合は、受信している拡張系列を減らして前記エラー訂正用のデータ系列を更に受信し、前記データ損失率が所定の閾値より大きく拡張系列を受信していない場合は、前記エラー訂正用のデータ系列を更に受信することを特徴とする。

【００３９】上記目的を達成するために、請求項２９記載の発明は、前記所定の閾値は、前記符号化データの符号化方式に応じて決定されることを特徴とする。

【００４０】上記目的を達成するために、請求項３０記載の発明は、前記送信側のデータ通信装置からインターネット等のネットワークを介して動画像等のデータが同報されるマルチキャスト通信に適用可能であることを特徴とする。

【００４１】上記目的を達成するために、請求項３１記載の発明は、送信側のデータ通信装置及び複数の受信側のデータ通信装置との間でネットワークを介してデータの送受信を行うデータ通信システムに適用されるデータ通信方法であって、前記送信側のデータ通信装置は、前記データを階層的に符号化して符号化データを生成する符号化ステップと、該符号化ステップで階層的に符号化されたそれぞれの符号化データに対しエラー訂正用のデータを生成する訂正用データ生成ステップと、前記階層的に符号化された符号化データと前記エラー訂正用のデータとを各々異なるデータ系列として送信する送信ステップとを有し、前記受信側のデータ通信装置は、前記各々異なるデータ系列の中から受信状態に基づいて適切なデータ系列を選択する選択ステップと、該選択ステップで選択したデータ系列を受信する受信ステップとを有することを特徴とする。

【００４２】上記目的を達成するために、請求項３２記載の発明は、前記送信ステップで送信するデータ系列は、前記データの符号化の階層に応じた基本系列、該基本系列の上位層である１つ以上の拡張系列、及び前記階層的に符号化されたデータに対して生成された各訂正用データに応じた訂正用データ系列であることを特徴とする。

【００４３】上記目的を達成するために、請求項３３記載の発明は、前記基本系列は、前記選択ステップにおいて前記データ系列の中から必ず選択されることを特徴とする。　上記目的を達成するために、請求項３４記載の発明は、更に、前記送信側のデータ通信装置は、前記符号化ステップで階層的に符号化された符号化データをパケット化してデータパケットを生成するデータパケット化ステップと、前記エラー訂正用のデータを用いてエラー訂正用パケットを生成する訂正用データパケット化ステップとを有し、前記訂正用データ生成ステップでは、前記データパケットを用いて前記エラー訂正用のデータを生成し、前記送信ステップでは、前記データパケットと前記エラー訂正用パケットとをそれぞれ前記符号化データのデータ系列と前記エラー訂正用のデータのデータ系列として送信することを特徴とする。

【００４４】上記目的を達成するために、請求項３５記載の発明は、前記送信ステップでは、前記データ系列内のデータパケット毎にデータ送信時刻情報及び順序番号を付加して送信することを特徴とする。

【００４５】上記目的を達成するために、請求項３６記載の発明は、前記訂正用データ生成ステップでは、前記階層的に符号化されたデータのデータパケットを参照し該データパケットの符号化データ部分だけを用いて前記エラー訂正用のデータを生成し、前記訂正用データパケット化ステップでは、エラー訂正時に最低限必要な情報のみを含むペイロードヘッダを生成し、前記エラー訂正用のデータと前記ペイロードヘッダを用いて前記エラー訂正用パケットを生成することを特徴とする。

【００４６】上記目的を達成するために、請求項３７記載の発明は、前記受信側のデータ通信装置は、更に、前記受信状態を取得する状態取得ステップを有することを特徴とする。

【００４７】上記目的を達成するために、請求項３８記載の発明は、前記状態取得ステップでは、前記受信状態としてデータ損失率、送信レート、受信レートを取得することを特徴とする。

【００４８】上記目的を達成するために、請求項３９記載の発明は、前記選択ステップでは、前記データ損失率が所定の閾値より小さく前記送信レートと前記受信レートとの比が所定の閾値より大きい場合は更に上位層の符号化データのデータ系列である拡張系列を受信し、前記データ損失率が所定の閾値より小さく前記送信レートと前記受信レートとの比が所定の閾値より小さい場合は受信している訂正用のデータ系列を減らし、前記データ損失率が所定の閾値より大きく前記送信レートと前記受信レートとの比が所定の閾値より大きい場合は訂正用のデータ系列を更に受信し、前記データ損失率が所定の閾値より大きく前記送信レートと前記受信レートとの比が所定の閾値より小さい場合は受信する拡張系列を上位層から順に減らすことを特徴とする。

【００４９】上記目的を達成するために、請求項４０記載の発明は、前記状態取得ステップでは、前記受信状態としてデータ損失率を取得することを特徴とする。

【００５０】上記目的を達成するために、請求項４１記載の発明は、前記選択ステップでは、前記データ損失率が所定の閾値より小さく前記エラー訂正用のデータ系列

を受信中の場合は、受信しているエラー訂正用のデータ系列を減らして更に上位層の符号化データのデータ系列である拡張系列を受信し、前記データ損失率が所定の閾値より小さく前記エラー訂正用のデータ系列を受信していない場合は、更に上位層の符号化データのデータ系列である拡張系列を受信し、前記データ損失率が所定の閾値より大きく拡張系列を受信中の場合は、受信している拡張系列を減らして前記エラー訂正用のデータ系列を更に受信し、前記データ損失率が所定の閾値より大きく拡張系列を受信していない場合は、前記エラー訂正用のデータ系列を更に受信することを特徴とする。

【００５１】上記目的を達成するために、請求項４２記載の発明は、前記所定の閾値は、前記符号化データの符号化方式に応じて決定されることを特徴とする。

【００５２】上記目的を達成するために、請求項４３記載の発明は、前記送信側のデータ通信装置からインターネット等のネットワークを介して複数の受信側のデータ通信装置に動画像等のデータを同報するマルチキャスト通信に適用可能であることを特徴とする。

【００５３】上記目的を達成するために、請求項４４記載の発明は、送信側のデータ通信装置及び複数の受信側のデータ通信装置との間でネットワークを介してデータの送受信を行うデータ通信システムに適用されるデータ通信方法を実行するプログラムを記憶したコンピュータにより読み出し可能な記憶媒体であって、前記データ通信方法は、前記データを階層的に符号化して符号化データを生成する符号化ステップと、該符号化ステップで階層的に符号化されたそれぞれの符号化データに対しエラー訂正用のデータを生成する訂正用データ生成ステップと、前記階層的に符号化された符号化データと前記エラー訂正用のデータとを各々異なるデータ系列として送信するように制御する送信ステップと、前記各々異なるデータ系列の中から受信状態に基づいて適切なデータ系列を選択する選択ステップと、該選択ステップで選択したデータ系列を受信するように制御する受信ステップとを有することを特徴とする。

【００５４】上記目的を達成するために、請求項４５記載の発明は、前記送信ステップで送信制御するデータ系列は、前記データの符号化の階層に応じた基本系列、該基本系列の上位層である１つ以上の拡張系列、及び前記階層的に符号化されたデータに対して生成された各訂正用データに応じた訂正用データ系列であることを特徴とする。

【００５５】上記目的を達成するために、請求項４６記載の発明は、前記基本系列は、前記選択ステップにおいて前記データ系列の中から必ず選択されることを特徴とする。

【００５６】上記目的を達成するために、請求項４７記載の発明は、更に、前記符号化ステップで階層的に符号化された符号化データをパケット化してデータパケットを生成するデータパケット化ステップと、前記エラー訂正用のデータを用いてエラー訂正用パケットを生成する訂正用データパケット化ステップとを有し、前記訂正用データ生成ステップでは、前記データパケットを用いて前記エラー訂正用のデータを生成し、前記送信ステップでは、前記データパケットと前記エラー訂正用パケットとをそれぞれ前記符号化データのデータ系列と前記エラー訂正用のデータのデータ系列として送信するように制御することを特徴とする。

【００５７】上記目的を達成するために、請求項４８記載の発明は、前記送信ステップでは、前記データ系列内のデータパケット毎にデータ送信時刻情報及び順序番号を付加して送信するように制御することを特徴とする。

【００５８】上記目的を達成するために、請求項４９記載の発明は、前記訂正用データ生成ステップでは、前記階層的に符号化されたデータのデータパケットを参照し該データパケットの符号化データ部分だけを用いて前記エラー訂正用のデータを生成し、前記訂正用データパケット化ステップでは、エラー訂正時に最低限必要な情報のみを含むペイロードヘッダを生成し、前記エラー訂正用のデータと前記ペイロードヘッダを用いて前記エラー訂正用パケットを生成することを特徴とする。

【００５９】上記目的を達成するために、請求項５０記載の発明は、更に、前記受信状態を取得する状態取得ステップを有することを特徴とする。

【００６０】上記目的を達成するために、請求項５１記載の発明は、前記状態取得ステップでは、前記受信状態としてデータ損失率、送信レート、受信レートを取得することを特徴とする。

【００６１】上記目的を達成するために、請求項５２記載の発明は、前記選択ステップでは、前記データ損失率が所定の閾値より小さく前記送信レートと前記受信レートとの比が所定の閾値より大きい場合は更に上位層の符号化データのデータ系列である拡張系列を受信するように制御し、前記データ損失率が所定の閾値より小さく前記送信レートと前記受信レートとの比が所定の閾値より小さい場合は受信している訂正用のデータ系列を減らし、前記データ損失率が所定の閾値より大きく前記送信レートと前記受信レートとの比が所定の閾値より大きい場合は訂正用のデータ系列を更に受信するように制御し、前記データ損失率が所定の閾値より大きく前記送信レートと前記受信レートとの比が所定の閾値より小さい場合は受信する拡張系列を上位層から順に減らすことを特徴とする。

【００６２】上記目的を達成するために、請求項５３記載の発明は、前記状態取得ステップでは、前記受信状態としてデータ損失率を取得することを特徴とする。

【００６３】上記目的を達成するために、請求項５４記載の発明は、前記選択ステップでは、前記データ損失率が所定の閾値より小さく前記エラー訂正用のデータ系列

を受信中の場合は、受信しているエラー訂正用のデータ系列を減らして更に上位層の符号化データのデータ系列である拡張系列を受信するように制御し、前記データ損失率が所定の閾値より小さく前記エラー訂正用のデータ系列を受信していない場合は、更に上位層の符号化データのデータ系列である拡張系列を受信するように制御し、前記データ損失率が所定の閾値より大きく拡張系列を受信中の場合は、受信している拡張系列を減らして前記エラー訂正用のデータ系列を更に受信するように制御し、前記データ損失率が所定の閾値より大きく拡張系列を受信していない場合は、前記エラー訂正用のデータ系列を更に受信するように制御することを特徴とする。

【００６４】上記目的を達成するために、請求項５５記載の発明は、前記所定の閾値は、前記符号化データの符号化方式に応じて決定されることを特徴とする。

【００６５】上記目的を達成するために、請求項５６記載の発明は、前記送信側のデータ通信装置からインターネット等のネットワークを介して複数の受信側のデータ通信装置に動画像等のデータを同報するマルチキャスト通信に適用可能であることを特徴とする。

【００６６】

【発明の実施の形態】以下、本発明の第１の実施の形態並びに第２の実施の形態を図面に基づいて詳細に説明する。

【００６７】［第１の実施の形態］図１は本発明の第１の実施の形態に係るデータ通信装置の構成を示すブロック図である。本発明の第１の実施の形態に係るデータ通信装置は、送信端末１－１と、複数の受信端末１－２１、１－２２…とがネットワーク１－３を介して通信可能に構成されている。図１は送信端末１－１が送信するデータをネットワーク１－３を通して受信端末１－２１、１－２２…で受信する場合における各端末の内部構成と接続関係を示したものである。

【００６８】更に、上記の送信端末１－１は、データ生成部１－１１、レイヤ１送信部（ＢａｓｅＬａｙｅｒ １）１－１２１、レイヤ２送信部（ＦＥＣＬａｙｅｒ １）１－１２２、レイヤ３送信部（Ｅｎｈａｎｃｅｍｅｎｔ Ｌａｙｅｒ ２）１－１２３、レイヤ４送信部（ＦＥＣ Ｌａｙｅｒ ２）１－１２４、レイヤ５送信部（Ｅｎｈａｎｃｅｍｅｎｔ Ｌａｙｅｒ ３）１－１２５を備えている。更に、上記の受信端末１－２１は、データ受信部１－２１１、データ処理部１－２１２、受信レイヤ選択部１－２１３、受信状況モニタ部１－１２４を備えている。尚、他の受信端末１－２２…も上記受信端末１－２１と同様構成のため図示を省略する。

【００６９】ここで、本発明の第１の実施の形態におけるネットワーク１－３とは、組織内で運営されているＬＡＮ（Local Area Network）から、いわゆるインターネットのような不特定多数のネットワークが結合したような大規模なものまで含むものであり、その形態について特定するものではない。

【００７０】上記構成を動作と共に詳述すると、送信端末１－１が送信するデータとしては、具体的には例えばビデオカメラでキャプチャされた映像データなどが考えられるが、データの内容としては映像に限るものではない。送信端末１－１において、データ生成部１－１１は、送信するメディアを階層的に符号化する。階層符号化を用いているので、Ｂａｓｅレイヤ（基本系列）のみで再現した場合は品質は悪いが最低限メディアを再現できる。上位のＥｎｈａｎｃｅｍｅｎｔレイヤ（拡張系列）はＢａｓｅレイヤと併せて用いることで、より高品質にメディアを再現できる。例えば映像の場合だと、解像度が高くフレームレートの高い画像となっていく。階層符号化されたデータは、送信のためにパケット化され、そのパケット化されたデータをもとにそれぞれの階層についてエラー訂正のためのＦＥＣデータが生成される。ＦＥＣデータとしては、パリティパケットなどが用いられるものとする。

【００７１】ＢａｓｅレイヤとＥｎｈａｎｃｅｍｅｎｔレイヤ及びそれぞれに対するエラー訂正レイヤが、それぞれ別のストリームとして別のレイヤ送信部（データ送信部）１－１２１～１－１２５に送られる。レイヤ送信部（データ送信部）１－１２１～１－１２５は、パケット毎にシーケンス番号及びデータを送信する時刻の情報を付加し、ネットワーク１－３にそれぞれのレイヤを別のストリームとして送出し、マルチキャスト（同じ情報を特定の複数の宛先に配信すること）する。どのレイヤを受信するかは、受信端末１－２１、１－２２…で選択できるものとする。

【００７２】一方、各受信端末１－２１、１－２２…は、送信されている各レイヤのうち適当なものだけを受信する。受信されたデータは、データ処理部１－２１２に送られ処理される。例えばデータが映像の場合には、映像を表示するための処理（復号化及び表示処理など）がデータ処理部１－２１２で行われる。各受信端末１－２１、１－２２…では、データ受信中、受信状況モニタ部１－２１４がパケットロス、伝送遅延といった受信状況をモニタし、その情報を受信レイヤ選択部１－２１３に送る。受信レイヤ選択部１－２１３は、送られてきた受信状況に応じて受信すべきレイヤを決定する。受信レイヤ選択部１－２１３は、決定したレイヤに関して受信を行うようにデータ受信部１－２１１に報告し、データ受信部１－２１１が、その指定されたレイヤを受信し続ける。

【００７３】次に、上記の如く構成された本発明の第１の実施の形態に係るデータ通信装置の送信端末１－１及び各受信端末１－２１、１－２２…の動作について図２～図４を参照しながら説明する。図２は本発明の第１の実施の形態に係るデータ通信装置の送信端末側のデータ送信処理を示すフローチャート、図３は本発明の第１の

実施の形態に係るデータ通信装置の受信端末側のデータ受信処理を示すフローチャート、図４は本発明の第１の実施の形態に係るデータ通信装置の受信端末１－２１、１－２２…における受信レイヤ選択処理を示すフローチャートである。

【００７４】最初に、データ通信装置の送信端末１－１の動作を図２のフローチャートに基づき説明する。

【００７５】先ず、送信端末１－１では、送信すべきデータを取り込み（ステップＳ２０１）、そのデータを階層符号化する（ステップＳ２０２）。階層符号化技術により、一番下位のＢａｓｅレイヤを基に、Ｅｎｈａｎｃｅｍｅｎｔレイヤを下位から順次加えることにより、徐々に品質が向上するように圧縮を行うものとする。それぞれの階層のデータはパケット化され、Ｂａｓｅレイヤのストリームと各Ｅｎｈａｎｃｅｍｅｎｔレイヤのストリームが生成される（ステップＳ２０３）。例えば３階層に符号化した場合には、Ｂａｓｅレイヤのストリームは１層、Ｅｎｈａｎｃｅｍｅｎｔレイヤのストリームは２層生成されることになる。

【００７６】そして、それぞれの階層のデータについてデータパケットを参照し、エラー訂正のためのパケットを生成し、ＦＥＣレイヤのデータストリームが各階層について１ストリームずつ生成される（ステップＳ２０４）。エラー訂正には、パリティパケット等が使われ得る。このようにして、階層化されたメディアデータとＦＥＣデータにより、データストリームのレイヤが生成され、それぞれ別のデータストリームとしてネットワーク１－３上に送出される（ステップＳ２０５）。ネットワーク１－３にデータが送出される際（ステップＳ２０５）、パケットには、ストリーム毎で管理するシーケンス番号と送信時刻のタイムスタンプの情報が付与される。

【００７７】次に、本発明の第１の実施の形態に係るデータ通信装置の各受信端末１－２１、１－２２…の動作を図３のフローチャートに基づき説明する。

【００７８】各受信端末１－２１、１－２２…では、送信端末１－１からネットワーク１－３を介して送信されてきたデータをデータ受信部１－２１１で受信する（ステップＳ３０１）。送信端末１－１から送られてきたデータは、データ処理部１－２１２で処理される（ステップＳ３０２）。送信端末１－１から例えば映像データが送られてきた場合、映像の表示などを行う。

【００７９】各受信端末１－２１、１－２２…は、一方で、定期的に送受信状況の統計情報をモニタする（ステップＳ３０３）。この時の送受信状況としては、パケットロス率や送信レート、受信レートなどが挙げられる。パケットロス率は、送信データに付与されたシーケンス番号のうち欠落しているものの数から計測できる。送信レートは、送信データに付与されたタイムスタンプとシーケンス番号から推測できる。また、受信レートは、受信データのパケットサイズと時刻のログにより容易に計算できる。そして、その送受信状況から、その受信端末が受信すべきデータのレイヤを選択する（ステップＳ３０４）。選択により受信レイヤに変更があった場合には、実際に受信するレイヤを変更し（ステップＳ３０５）、変更後、受信することになったレイヤのデータについてデータの受信を継続する。

【００８０】次に、本発明の第１の実施の形態に係るデータ通信装置の受信端末１－２１、１－２２…における受信レイヤ選択処理を図４のフローチャートに基づき説明する。

【００８１】先ず、パケットロス率を調べ、閾値（例えば５％）と比較し（ステップＳ４０１）、次に送信レートに対する受信レートの比を閾値（例えば０.９）と比較する（ステップＳ４０２）。ロス率が閾値より小さく、送受信レート比が閾値より大きい場合には、帯域に余裕がありロスも少ないということなので、更に上位層のＥｎｈａｎｃｅｍｅｎｔレイヤを受信するものとする（ステップＳ４０３）。ロス率が閾値より小さく、送受信レート比も閾値より小さい場合には、ロスは少なく通信路の品質は良いと思われるが、送信したものを十分に受信できておらず、送信されているデータ量を十分に受信するだけの帯域幅がないものと思われる。この場合には、無駄に冗長なＦＥＣレイヤを受信する必要がないため、受信しているＦＥＣレイヤを減らす（ステップＳ４０４）。

【００８２】ロス率が閾値よりも大きく、送受信レート比が閾値より十分大きい場合には、ネットワーク１－３の帯域幅は十分であるが、通信路に信頼性がないと考えられるので、ＦＥＣレイヤを新たに受信し始める（ステップＳ４０６）。一方、ロス率が閾値より大きく、送受信レート比が閾値より小さい場合には、根本的に帯域幅が不足しているものと思われるので、受信するＥｎｈａｎｃｅｍｅｎｔレイヤを上位のものから順に減らす（ステップＳ４０７）。この際、その受信をとり止めるＥｎｈａｎｃｅｍｅｎｔレイヤに関するＦＥＣレイヤも受信していた場合にはこのＦＥＣレイヤの受信も止める。

【００８３】以上のようなステップを繰り返し、送信端末１－１は、階層符号化されたデータとエラー訂正のためのＦＥＣにより、生成された複数のレイヤのデータストリームをネットワーク１－３上に送出する。受信端末１－２１、１－２２…では、受信状況に応じて上記のように適切なレイヤのデータを選択し受信する。

【００８４】図５は本発明の第１の実施の形態に係る上記手法により実現できる階層化されたデータの送受信状況を示す説明図である。図中、上側が送信側で、階層符号化とエラー訂正により用意されている階層的なデータの例である。本例では、Ｂａｓｅレイヤと２つのＥｎｈａｎｃｅｍｅｎｔレイヤが生成されている。計３つのデータストリームにそれぞれ１層ずつ３層のエラー訂正の

ためのＦＥＣレイヤが用意されている。ネットワーク帯域の狭い受信端末（クライアント）は、図中ＡのようにＢａｓｅストリームのみ受信することになる。

【００８５】一方、ある程度ネットワーク帯域の広い受信端末（クライアント）は、例えば図中ＢやＣのように３つのデータストリームを受信することになるが、パケットロスの多い不安定なネットワークによって接続されている受信端末は、図中ＢのようにＦＥＣストリームを受信する。一方、パケットロスの少ない信頼性のあるネットワークで接続されている受信端末は、図中ＣのようにＦＥＣストリームを受信せず、メディアデータストリームを高品質な最上位層まで受信することになる。

【００８６】図６は上述した本発明の第１の実施の形態に係るデータ通信装置をデータ通信システムに適用した具体例を示すブロック図である。本発明の第１の実施の形態に係るデータ通信システムは、カメラサーバ１０と、クライアント２０とから大略構成されている。更に、カメラサーバ１０は、カメラ１００、キャプチャ部１０１、インタフェース１０２、ＣＰＵ１０３、ＲＯＭ１０４、ＲＡＭ１０５、外部記憶装置１０６、キーボード１０７、表示装置１０８、通信インタフェース１０９を備えている。更に、クライアント２０は、ＣＰＵ２０３、ＲＯＭ２０４、ＲＡＭ２０５、外部記憶装置２０６、キーボード２０７、表示装置２０８、通信インタフェース２０９を備えている。図中３００はネットワークを示す。

【００８７】上記構成を詳述すると、カメラサーバ１０は、カメラ１００で撮影した映像データをネットワーク３００を介してクライアント２０に転送する。図６の構成と上記図１の構成との対応は、カメラサーバ１０は送信端末１－１に対応し、クライアント２０は受信端末１－２１に対応することは理解できよう。更に、このクライアント２０がネットワーク３００で接続された異なる場所に複数存在することになる。

【００８８】さて、カメラサーバ１０、クライアント２０のハードウェア的な違いは、カメラ、キャプチャ部を備えているか否かの違いであり、カメラサーバ１０、クライアント２０双方とも例えばパーソナルコンピュータで実現できるものである。つまり、符号１０３～１０９と符号２０３～２０９は実質的に同じ構成であり、それぞれが汎用のコンピュータ（例えばパーソナルコンピュータ）で実現できるものである。

【００８９】一方、ソフトウェア的には、カメラサーバ１０では、キャプチャした映像データを圧縮しエラー訂正のデータを生成しクライアント２０に転送するためのソフトウェア（外部記憶装置１０６に格納され、ＲＡＭ１０５にロードされ実行される）が動作しており、クライアント２０では、映像データを受信しそれを表示するソフトウェア（外部記憶装置２０６に格納され、ＲＡＭ２０５にロードされ実行される）が動作する点で異なる。データの圧縮については、キャプチャカードでハードウェア的に行うこともソフトウェア的に行うことも可能であるが、階層符号化技術を用いて圧縮できることが本発明の第１の実施の形態を実現するための条件となる。

【００９０】但し、本例では、便宜的にカメラサーバ１０とクライアント２０に分けて示しただけであり、双方にビデオキャプチャ機能を付加した場合には、双方がカメラサーバ及びクライアントとして機能することができるものである。

【００９１】さて、先に説明した上記図１のデータ通信装置の動作を図６のデータ通信システムに適用する場合の動作について図７～図９のフローチャートを参照しながら説明する。図７は本発明の第１の実施の形態に係るカメラサーバにおける送信処理を示すフローチャート、図８は本発明の第１の実施の形態に係るクライアントにおけるデータ受信処理を示すフローチャート、図９は本発明の第１の実施の形態に係るクライアントにおける受信レイヤ変更処理を示すフローチャートである。

【００９２】最初に、カメラサーバ１０の動作から説明する（図７）。先ず、カメラサーバ１０では、キャプチャ間隔に従ってキャプチャ部１０１でカメラ１００からキャプチャした映像の取り込みを行う（ステップＳ７０１）。キャプチャ部１０１でキャプチャされた映像は、複数の階層に階層符号化される（ステップＳ７０２）。次に、各階層毎に適当な大きさのパケットに分割される（ステップＳ７０３）。更に、パケット化された各レイヤのメディアデータについて、エラー訂正のためのパリティパケットを生成する（ステップＳ７０４）。パリティパケットは、メディアデータの数パケットに一つ付加するものとする。

【００９３】このようにして生成された各レイヤのデータは、次のキャプチャタイミングに間に合うようにレート調整され、それぞれ別のデータストリームとしてネットワーク３００上に送信される（ステップＳ７０５）。以上のようにカメラサーバ１０は、定期的に映像のキャプチャから送信までを繰り返す。

【００９４】一方、クライアント２０の処理であるが、最初にデータ受信処理（図８）について説明する。先ず、クライアント２０では、カメラサーバ１０から到着した受信レイヤのデータを受信する（ステップＳ８０１）。一フレームのデータが到着した段階で、パケットロスを調べ、ロスがある場合にはエラー訂正パケットによって回復を行う（ステップＳ８０２）。次に、エラー訂正後のデータをデコードして映像を生成し（ステップＳ８０３）、表示装置２０８へ表示を行う（ステップＳ８０４）。

【００９５】次に、クライアント２０での受信レイヤ変更処理（図９）について説明する。先ず、クライアント２０では、起動時に初期受信レイヤが決められ（ステッ

ブＳ８１１）、初期レイヤ変更タイマが設定される（ステップＳ８１２）。次に、初期レイヤ変更タイマの時間が切れているかどうかをチェックし（ステップＳ８１３）、初期レイヤ変更タイマの時間が過ぎている場合には、受信状況の統計情報をチェックする（ステップＳ８１４）。次に、その受信状況から上述の手法（図４）に従って受信レイヤを決定し変更する（ステップＳ８１５）。この受信レイヤの変更が上記の受信処理の指定受信レイヤの変更として影響を及ぼす。この後、再び受信レイヤ変更タイマが設定され（ステップＳ８１６）、上記ステップＳ８１３に戻り、上記ステップＳ８１３からステップＳ８１６の処理を繰り返す。

【００９６】以上の結果、ネットワークを介しての複数の受信端末への同時データ転送は、送信端末側で階層符号化とエラー訂正により複数のストリームを生成し、受信端末毎のネットワークの状況に応じて受信端末が最適な受信データストリームを選択することにより、最適なデータ転送が行うことができるようになる。

【００９７】上記実施形態で対象とするネットワークとしてインターネットを想定した場合、ネットワークへのデータの送出法としては、ＩＥＴＦ（Internet EngineeringTask Force）より標準化されているＩＰ（Internet Protocol）マルチキャストを使用することができる。この際には、受信端末が、複数のレイヤから受信するストリームを選択する方法として、ＩＧＭＰ（Internet Group Membership Protocol）を使用したマルチキャストグループへのｊｏｉｎとｌｅａｖｅのメッセージを使用することができる。

【００９８】また、上記実施形態のＢａｓｅレイヤ及びＥｎｈａｎｃｅｍｅｎｔレイヤのデータレートであるが、これはネットワークの種類及びそのネットワークに接続するインタフェースの種類によって適宜設定できるようにすることが望まれる。例えば、社内で上記システムを構築するのであれば、イーサネット（Ｅｔｈｅｒｎｅｔ：米国ゼロックス・ＤＥＣ・インテル三社が共同開発したバス構造のＬＡＮ、伝送速度：１０Ｍｂｐｓや１００Ｍｂｐｓ）であろうから、高い転送レートに設定できるであろう。

【００９９】以上説明したように、本発明の第１の実施の形態に係るデータ通信装置によれば、送信対象メディアのデータを階層的に符号化するデータ生成部１－１１、階層符号化データを各々異なるデータストリームとして送信すると共に各データストリームに対しエラー訂正用のデータを生成し各々別のストリームとして送信するレイヤ送信部１－１２１～１－１２５を備えた送信端末１－１と、受信状況をモニタする受信状況モニタ部１－２１４、受信状況に基づき適切なデータストリームを選択する受信レイヤ選択部１－２１３、選択したデータストリームを受信するデータ受信部１－２１１を備えた受信端末１－２１とを有するため、下記のような作用及び効果を奏する。

【０１００】上記構成において、送信端末１－１では、送信対象データの階層符号化、各階層のデータのパケット化、Ｂａｓｅレイヤのストリームと各Ｅｎｈａｎｃｅｍｅｎｔレイヤのストリームの生成、各階層のデータについてエラー訂正のためのパケットの生成、ＦＥＣレイヤのデータストリームを各階層について１ストリームずつ生成、階層化メディアデータとＦＥＣデータによりデータストリームのレイヤの生成を行い、各々別のデータストリームとしてネットワーク１－３に送出する。パケットには、ストリーム毎で管理するシーケンス番号と送信時刻のタイムスタンプの情報を付与する。

【０１０１】受信端末１－２１、１－２２…では、定期的に送受信状況の統計情報のモニタ、送受信状況に基づき受信すべきデータのレイヤの選択、受信レイヤ選択に基づく受信レイヤの変更を行い、変更後の受信レイヤのデータについてデータの受信を継続する。

【０１０２】また、受信端末１－２１、１－２２…では、パケットのロス率が閾値より小さく送受信レート比が閾値より大きい場合、更に上位層のＥｎｈａｎｃｅｍｅｎｔレイヤを受信し、ロス率が閾値より小さく送受信レート比も閾値より小さい場合、受信しているＦＥＣレイヤを減らし、ロス率が閾値よりも大きく送受信レート比が閾値より十分大きい場合、ＦＥＣレイヤを新たに受信し、ロス率が閾値より大きく送受信レート比が閾値より小さい場合、受信するＥｎｈａｎｃｅｍｅｎｔレイヤを上位のものから順に減らす。

【０１０３】これにより、本発明の第１の実施の形態においては、送信端末からネットワークを介して複数の受信端末にデータ伝送する際、受信端末毎に異なる介在するネットワークの状況に応じて、最適な品質及び最適なエラー耐性をもったデータを伝送することが可能となる。従って、カメラで撮影された生の映像を同時に多数の視聴者に中継するようなリアルタイム性を必要とする場合に特に有効に作用するという優れた効果が得られる。

【０１０４】［第２の実施の形態］図１０は本発明の第２の実施の形態に係るデータ通信装置の構成を示すブロック図である。本発明の第２の実施の形態に係るデータ通信装置は、送信側端末１００１、受信側端末１００２がネットワーク１０２１を介して通信可能に構成されている。更に、上記の送信側端末１００１は、画像キャプチャ装置１０１０、符号化装置１０１１、データ送信部１０１２、ＦＥＣデータ生成部１０１３、ＦＥＣデータ送信部１０１４を備えている。更に、上記の受信側端末１００２は、データ受信部１０３１、ＦＥＣデータ受信部１０３２、エラー訂正部１０３３、復号装置１０３４、画像表示装置１０３５、受信系列選択部１０３６を備えている。

【０１０５】上記の送信側端末１００１及び受信側端末

１００２の各部の概略機能を説明すると、送信側端末１００１において、画像キャプチャ装置１０１０は、表示画面の画像をファイルとして取り込む。符号化装置１０１１は、入力された映像信号から階層的なデータ系列を生成する。データ送信部１０１２は、符号化データに基づきデータパケットを生成し、符号化の階層に応じて基本系列と拡張系列とを形成しネットワーク１０２１に送出する。ＦＥＣデータ生成部１０１３は、各系列のデータパケットに基づきＦＥＣデータを生成する。ＦＥＣデータ送信部１０１４は、ＦＥＣデータをパケット化してネットワーク１０２１に送出する。

【０１０６】他方、受信側端末１００２において、データ受信部１０３１は、ネットワーク１０２１を介して符号化データを受信する。ＦＥＣデータ受信部１０３２は、ネットワーク１０２１を介してＦＥＣデータを受信する。エラー訂正部１０３３は、ロスパケットの復元処理を行う。復号装置１０３４は、符号化データを復号する。画像表示装置１０３５は、受信した画像の表示を行う。受信系列選択部１０３６は、パケットロスの情報に基づき一定時間間隔で受信系列の切り替えを行う。

【０１０７】更に、上記の送信側端末１００１及び受信側端末１００２の要部の機能を動作と共に詳述する。先ず、送信側端末１００１の機能及び動作について説明する。符号化装置１０１１は、入力された映像信号から階層的なデータ系列を生成する。階層的の方法については、一つの符号化器が解像度やＳＮ比の異なる複数の符号化データを出力する方法や、複数の符号化器を用いてフレームレートの異なる符号化系列を出力する方法などを用いることができるが、ここではその方法について特定するものではない。符号化されたデータはデータ送信部１０１２に送られここでデータパケットが生成され、それぞれ符号化の階層に応じて基本系列と拡張系列とを形成してネットワーク１０２１に送出される。

【０１０８】例えばマルチキャストにおいては、１つの送信系列は１つのマルチキャストグループに相当する。同時に、データパケットはＦＥＣデータ生成部１０１３に送られ、各系列のデータパケットを基にＦＥＣデータが生成され、ＦＥＣデータはＦＥＣデータ送信部１０１４によりパケット化されてネットワーク１０２１に送出される。同じくマルチキャストにおいては１つのＦＥＣデータ系列は１つのマルチキャストグループに相当する。また、データ送信部１０１２では各系列毎に独立してデータパケットにシーケンスナンバ（順序番号）やタイムスタンプ（データ送信時刻情報）が付加され、ＦＥＣデータ生成部１０１３ではＦＥＣデータに使用したデータパケットのシーケンスナンバやパケット数などがヘッダ情報として付加される。

【０１０９】次に、受信側端末１００２の機能及び動作について説明する。受信系列選択部１０３６により選択された系列のみをデータ受信部１０３１で受信する。ここでパケットに付加されたシーケンスナンバからパケットロスを検出して受信系列選択部１０３６に報告する。受信系列選択部１０３６では報告されたパケットロスの情報を集計してそれを基に一定時間間隔で受信系列の切り替えを行う。受信されたデータは、ＦＥＣデータを受信している場合はエラー訂正部１０３３に送られ、ロスパケットの復元処理が行われる。復号装置１０３４でデータパケットを復号可能な単位（例えば１フレーム）に再構成した後、映像信号に復号する。

【０１１０】図２０は本発明のプログラム及び関連データが記憶媒体から装置に供給される概念例を示す説明図である。本発明のプログラム及び関連データは、フロッピディスクやＣＤ－ＲＯＭ等の記憶媒体２００１を装置２００２に装備された記憶媒体ドライブの挿入口２００３に挿入することで供給される。その後、本発明のプログラム及び関連データを記憶媒体２００１から一旦ハードディスクにインストールしハードディスクからＲＡＭにロードするか、或いはハードディスクにインストールせずに直接ＲＡＭにロードすることで、本発明のプログラムを実行することが可能となる。

【０１１１】この場合、本発明の第２の実施の形態に係るデータ通信装置において本発明のプログラムを実行する場合は、例えば上記図２０に示したような手順でデータ通信装置（送信側端末１００１、受信側端末１００２）に本発明のプログラム及び関連データを供給するか、或いはデータ通信装置（送信側端末１００１、受信側端末１００２）に予め本発明のプログラム及び関連データを格納しておくことでプログラム実行が可能となる。

【０１１２】図１９は本発明のプログラム及び関連データを記憶した記憶媒体の記憶内容の構成例を示す説明図である。本発明の記憶媒体は、例えばボリューム情報１９０１、ディレクトリ情報１９０２、プログラム実行ファイル１９０３、プログラム関連データファイル１９０４等の記憶内容で構成される。本発明のプログラムは、後述の図１６のフローチャート等に基づきプログラムコード化されたものである。

【０１１３】尚、本発明の特許請求の範囲における各構成要件と、本発明の第２の実施の形態に係るデータ通信装置（送信側端末１００１、受信側端末１００２）の各部との対応関係は下記の通りである。符号化手段は送信側端末１００１の符号化装置１０１１に対応し、訂正用データ生成手段は送信側端末１００１のＦＥＣデータ生成部１０１３に対応し、送信手段は送信側端末１００１のデータ送信部１０１２、ＦＥＣデータ送信部１０１４に対応し、データパケット化手段は送信側端末１００１のデータ送信部１０１２に対応し、訂正用データパケット化手段は送信側端末１００１のＦＥＣデータ送信部１０１４に対応し、選択手段は受信側端末１００２の受信系列選択部１０３６に対応し、受信手段は受信側端末１

００２のデータ受信部１０３１、ＦＥＣデータ受信部１０３２に対応し、状態取得手段は受信側端末１００２の受信系列選択部１０３６が有する機能に対応する。また、送信側のデータ通信装置は送信側端末１００１に対応し、受信側のデータ通信装置は受信側端末１００２に対応し、ネットワークはネットワーク１０２１に対応する。

【０１１４】次に、上記の如く構成された本発明の第２の実施の形態に係るデータ通信装置におけるエラー訂正のためのデータの生成処理について、符号化方式としてＭｏｔｉｏｎ　ＪＰＥＧ（Joint Photographic Experts Group：カラー静止画像圧縮方式）を、またＦＥＣデータとしてパリティデータを用い、通信プロトコルにＲＴＰ（Rapid Transport Protocol：トランスポート層の高速プロトコル）／ＵＤＰ（User Datagram Protocol：マルチメディアプロトコルの１つ）／ＩＰ（Internet Protocol：ＯＳＩ参照モデルの第３層ネットワーク層のプロトコル）を利用する場合を例に図１１～図１５を参照しながら説明する。

【０１１５】送信側端末１００１の符号化装置１０１１に１フレーム分の映像データが入力され、ＪＰＥＧ圧縮が行われる。符号化されたデータは送信のためにパケット化されるが、このパケットサイズが通信路の最小ＭＴＵ（Max Transfer Unit：最大転送ユニット、Ｅｔｈｅｒｎｅｔで１５００ｂｙｔｅ）よりも大きい場合にはフラグメントが生じるために、生成されるパケットサイズがＭＴＵを超えないように予め符号化データを分割して複数のパケットを生成する。この時、送信の際に付加されるヘッダによるオーバーヘッドを極力小さくするために分割後のパケットサイズがＭＴＵと等しくなるように符号化データの先頭から分割を行う。分割したデータに８ｂｙｔｅのＲＴＰ　ＪＰＥＧペイロードヘッダ（図１１）と１２ｂｙｔｅのＲＴＰヘッダ（図１２）を付加して１つのＲＴＰパケットを構成する（ペイロード：セルで転送される情報）。

【０１１６】これら複数のパケットに対してＸＯＲ（exclusive OR）等のビット演算を施すことで１つまたは複数のＦＥＣデータを生成するが、その際、上記のようにＭＴＵ単位に分割されているＲＴＰパケット全体に対して演算を施した場合、生成したＦＥＣデータにＲＴＰ　ＦＥＣペイロードヘッダとＲＴＰヘッダを付加することによりＦＥＣパケットがＭＴＵサイズを超過しフラグメントが発生する（図１３）。これを避けるために、データパケットのうちのＪＰＥＧデータ部分のみを利用して元データと同じサイズのＦＥＣデータを生成する（図１４）。従って、このＦＥＣデータに付加することのできるヘッダサイズは元データのそれと同じ２０ｂｙｔｅであり、つまりＪＰＥＧペイロードヘッダと同じ８ｂｙｔｅのＦＥＣペイロードヘッダを設計すればよい。以下その方法を説明する。

【０１１７】先ず、複数のパケットに分割されたデータから元の符号化データを再構成するのに受信者側で必要とされるヘッダ情報は、

ＲＴＰヘッダ：データ長、マーカビット、タイムスタンプ

ＲＴＰ　ＪＰＥＧペイロードヘッダ：画像サイズ、Ｑ値、オフセット

の６つであり、ロストパケットの復元の際にはこれらの情報も復元する必要がある。また、ＦＥＣを使ってロストパケットを復元する際に必要な情報は、ＦＥＣデータ生成に用いられたパケットを識別するためのシーケンスナンバとパケット数である。これら８つのヘッダ情報が復元されることが必要となる。

【０１１８】先ず、これらの情報の中で、画像サイズ、Ｑ値（画像の圧縮率（元の静止画と圧縮後の静止画のデータ量の比）を指示するパラメタ）、タイムスタンプについては同一のフレーム内では一定であり、受信された前後のパケットの値を利用可能であるのでヘッダに含めない。次にオフセットについては、前後のパケットのデータ長とマーカビットが得られている場合にはこれらを用いて復元可能であるのでヘッダに含めない。従って、ヘッダに含める必要のある情報はデータ長、マーカビット、元データのシーケンスナンバとパケット数となる。ここでデータ長とマーカビットはＦＥＣデータ生成に用いた全てのパケットの分が必要なため、これらのＸＯＲをとったものをヘッダに含める。図１５にＦＥＣペイロードヘッダの構成を示す。尚、このＦＥＣパケット生成の手法は、第１の実施の形態においても適用可能である。

【０１１９】続いて、本発明の第２の実施の形態に係るデータ通信装置における受信側での受信系列の選択方法について階層化がフレームレートについて行われている場合を例に図１６を参照しながら具体的に説明する。

【０１２０】先ず、映像の受信を開始する際に受信者は基本系列のみ受信する（ステップＳ１６０１）。マルチキャストの場合には基本系列の送信されているマルチキャストグループへの参加に相当し、これにはＩＧＭＰのｊｏｉｎメッセージの送信が用いられる。基本系列の受信を開始した後、受信側端末１００２（受信者）は一定時間毎にパケットロス率を計測する（ステップＳ１６０２）。パケットロス率が所定の閾値を下回る場合は（ステップＳ１６０３でＮＯ）、通信路の状態が良好であって、ほぼ要求する受信レートでの受信が行えているのでデータをより多く受信することにより実効受信レートを上げることを考え、拡張系列の１つを新たに受信する（ステップＳ１６０７～ステップＳ１６０９）。尚、ステップＳ１６０７で現在、ＦＥＣ系列を受信しているかどうか判断し、受信していると判断したときは、受信しているＦＥＣ系列を１つ減らして（ステップＳ１６０８）、拡張系列の１つを新たに受信し（ステップＳ１６

０９）、一方、ステップＳ１６０７で受信していないと判断したときは、拡張系列の１つを新たに受信する（ステップＳ１６０９）。

【０１２１】また、この時、拡張系列のフレームデータによって基本系列のフレームデータが補間されるように送信側で階層化を行うことで、受信側でこれらを併合し適宜時間調整を行った後に表示した場合に実効フレームレートを上げることができる。尚、併合におけるフレーム順の決定にはパケットに付加されたタイムスタンプを用いることができる。

【０１２２】一方、上記計測したパケットロス率が閾値を上回る場合は（ステップＳ１６０３でＹＥＳ）、要求する受信レートが達成されず、拡張系列を受信してデータの受信レートを上げることによる効果が弱まる。そこで、ＦＥＣデータの系列を１つ新たに受信することで（ステップＳ１６０４～ステップＳ１６０６）、エラー耐性を高め、パケットロス率を修復することで実効受信レートを高めることができる。尚、ステップＳ１６０４で現在、拡張系列を受信しているかどうか判断し、受信していると判断したときは、受信している拡張系列を１つ減らして（ステップＳ１６０５）、ＦＥＣ系列の１つを新たに受信し（ステップＳ１６０６）、一方、ステップＳ１６０４で受信していないと判断したときは、ＦＥＣ系列の１つを新たに受信する（ステップＳ１６０９）。

【０１２３】このように、ある閾値を境に受信データレートを上げることとエラー耐性を高めることとを切り替えて受信することで、受信者は適切な受信品質を達成することができる。

【０１２４】次に、本発明の第２の実施の形態に係るデータ通信装置における上記パケットロス率の閾値の決定方法について図１７を参照しながら説明する。

【０１２５】この閾値を決定する要因としては、符号化方式と圧縮率、フレームサイズ、通信路のＭＴＵ、ＦＥＣの冗長度などといったことが挙げられる。ここではその決定方法として、送信側ではフレームサイズや圧縮率、ＦＥＣの冗長度などのパラメータを受信側に通知し、受信者側では通知されたパラメータから、図１７に示すような例えば符号化方式毎のテーブルを参照して対応する閾値の選択を行うものとする。こうしたテーブルは、実際のネットワークにおける実測値やシミュレーションなどを基に作成して、受信者に予め用意されているものとする。

【０１２６】次に、本発明の第２の実施の形態に係るデータ通信装置における送信系列のグループ化の例について図１８を参照しながら説明する。

【０１２７】本発明を実施する上で、基本系列は１つに限られるものではなく、マルチキャストが大規模になり受信者の接続されている通信路の帯域幅が数桁の範囲で異なるような状況においては、図１８に示すようにＩＳＤＮ（Integrated Service Digital Network：総合デジタル通信網）用の６４ｋｂｐｓ、３８４ｋｂｐｓ、ＬＡＮを対象とした１０Ｍｂｐｓといった回線毎の複数のグループを形成し、それぞれのグループの中で送信データ系列とエラー訂正データ系列を階層化する。そして、各受信者は予めそれぞれの通信環境に適したグループへの参加を行い、その後グループ内の系列を適切に選択して受信することによっても、本発明は実施される。

【０１２８】以上説明したように、本発明の第２の実施の形態に係るデータ通信装置によれば、送信側端末１００１は、データを階層的に符号化する符号化装置１０１１、階層的に符号化されたそれぞれのデータに対しＦＥＣデータを生成するＦＥＣデータ生成部１０１３、階層的に符号化されたデータとＦＥＣデータとを各々異なるデータ系列として送信するデータ送信部１０１２、ＦＥＣデータ送信部１０１４を有し、受信側端末１００２は、各々異なるデータ系列の中から適切なデータ系列を受信状態に基づき選択する受信系列選択部１０３６、選択したデータ系列を受信するデータ受信部１０３１、ＦＥＣデータ受信部１０３２を有するため、下記のような作用及び効果を奏する。

【０１２９】上記構成において、送信側端末１００１のデータ送信部１０１２は、データ系列内においてデータを送信する単位毎にデータ送信時刻情報（タイムスタンプ）及び順序番号（シーケンスナンバ）を付加して送信する。この場合、データ送信部１０１２により送信するデータ系列は、データの符号化の階層に応じた基本系列、該基本系列の上位層である１つ以上の拡張系列、及び階層的に符号化されたデータに対し生成されたＦＥＣデータに応じたＦＥＣデータ系列である。

【０１３０】受信側端末１００２では、受信状態としてデータ損失率（パケットロス率）を取得する。受信端末１００２の受信系列選択部１０３６は、データ損失率が所定の閾値より小さくＦＥＣデータ系列を受信中の場合は、受信しているＦＥＣデータ系列を減らして更に拡張系列を受信し、データ損失率が所定の閾値より小さくＦＥＣデータ系列を受信していない場合は、更に上位の拡張系列を受信し、データ損失率が所定の閾値より大きく拡張系列を受信中の場合は、受信している拡張系列を減らしてＦＥＣデータ系列を更に受信し、データ損失率が所定の閾値より大きく拡張系列を受信していない場合は、ＦＥＣデータ系列を更に受信する。

【０１３１】これにより、本発明の第２の実施の形態においては、ネットワークを介して多数の受信者と同時にデータ通信を行う場合に、各受信者がその通信環境と時々刻々の受信状況に応じて受信レートとＦＥＣデータの付与率を適応的に選択することにより、即ち、各受信者がそれぞれの受信環境に適した受信レート及びエラー耐性を選択することにより、良好な通信品質を実現することができるという優れた効果が得られる。特にマル

チキャスト環境においてリアルタイムな動画メディアを配信する場合に効果的である。

【０１３２】［他の実施の形態］上述した本発明の第１～第２の実施の形態においては、ネットワークの種類については特定しなかったが、本発明はインターネットなどの大規模なネットワークに適用すると効果が大きい。また、本発明はインターネット以外のＬＡＮなどの各種のネットワークを介したデータ通信にも適用可能である。

【０１３３】また、上述した本発明の第１の実施の形態においては、送信側端末としてカメラサーバを例に上げて説明したが、これによっても本発明が限定されるものではない。例えば、外部記憶装置に記憶されている動画ファイルを再生してクライアントにサービスする場合にも適用可能である。

【０１３４】また、上述した本発明の第２の実施の形態においては、送信側端末、受信側端末を上記図１０に示した如くネットワークに各１台ずつ接続した場合を例に上げたが、本発明は上記図１０の構成に限定されるものではなく、送信側端末、受信側端末をネットワークに任意の複数台数接続する場合にも適用可能である。

【０１３５】尚、本発明は、上記の実施形態を実現するための装置及び方法のみに限定されるものではなく、上記システムまたは装置内のコンピュータ（ＣＰＵ或いはＭＰＵ）に、上記実施形態を実現するためのソフトウェアのプログラムコードを供給し、このプログラムコードに従って上記システム或いは装置のコンピュータが上記各種デバイスを動作させることにより上記実施形態を実現する場合も本発明の範疇に含まれる。

【０１３６】またこの場合、上記ソフトウェアのプログラムコード自体が上記実施形態の機能を実現することになり、そのプログラムコード自体、及びそのプログラムコードをコンピュータに供給するための手段、具体的には上記プログラムコードを格納した記憶媒体は本発明の範疇に含まれる。

【０１３７】このようなプログラムコードを格納する記憶媒体としては、例えばフロッピーディスク、ハードディスク、光ディスク、光磁気ディスク、ＣＤ－ＲＯＭ、磁気テープ、不揮発性のメモリカード、ＲＯＭなどを用いることができる。

【０１３８】また、上記コンピュータが、供給されたプログラムコードのみに従って各種デバイスを制御することにより、上記実施形態の機能が実現される場合だけでなく、上記プログラムコードがコンピュータ上で稼働しているＯＳ（オペレーティングシステム）、或いは他のアプリケーションなどと共同して上記実施形態が実現される場合にも、かかるプログラムコードは本発明の範疇に含まれる。

【０１３９】更に、この供給されたプログラムコードが、コンピュータの機能拡張ボードやコンピュータに接続された機能拡張ユニットに備わるメモリに格納された後、そのプログラムコードの指示に基づいて、その機能拡張ボードや機能拡張ユニットに備わるＣＰＵなどが実際の処理の一部または全部を行い、その処理によって上記実施形態が実現される場合も本発明の範疇に含まれる。

【０１４０】

【発明の効果】以上説明したように、請求項１～１３記載のデータ通信システムによれば、ネットワークを介して多数の受信者と同時にデータ通信を行う場合に、各受信者がそれぞれの受信環境に適した受信レート及びエラー耐性を選択することにより、良好な通信品質を実現することができるという優れた効果が得られる。特にマルチキャスト環境においてリアルタイムな動画メディアを配信する場合に効果的である。

【０１４１】また、請求項１４～２０記載のデータ通信装置、請求項２１～３０記載のデータ通信装置によれば、送信側のデータ通信装置及び受信側のデータ通信装置によりデータ通信システムを構成することで、上記と同様に、良好な通信品質を実現することができるという優れた効果が得られる。特にマルチキャスト環境においてリアルタイムな動画メディアを配信する場合に効果的である。

【０１４２】また、請求項３１～４３記載のデータ通信方法によれば、データ通信方法をデータ通信システム（送信側のデータ通信装置及び受信側のデータ通信装置）に適用することで、上記と同様に、良好な通信品質を実現することができるという優れた効果が得られる。特にマルチキャスト環境においてリアルタイムな動画メディアを配信する場合に効果的である。

【０１４３】また、請求項４４～５６記載の記憶媒体によれば、記憶媒体からデータ送信方法を読み出してデータ通信システム（送信側のデータ通信装置及び受信側のデータ通信装置）で実行することで、上記と同様に、良好な通信品質を実現することができるという優れた効果が得られる。特にマルチキャスト環境においてリアルタイムな動画メディアを配信する場合に効果的である。

【図面の簡単な説明】

【図１】本発明の第１の実施の形態に係るデータ通信装置の構成例を示すブロック図である。

【図２】本発明の第１の実施の形態に係るデータ通信装置の送信端末側のデータ送信処理を示すフローチャートである。

【図３】本発明の第１の実施の形態に係るデータ通信装置の受信端末側のデータ受信処理を示すフローチャートである。

【図４】本発明の第１の実施の形態に係るデータ通信装置の受信端末での受信レイヤ選択処理を示すフローチャートである。

【図５】本発明の第１の実施の形態に係る階層化された

データの送受信状況を示す説明図である。

【図６】本発明の第１の実施の形態に係るデータ通信装置をデータ通信システムに適用した具体例を示すブロック図である。

【図７】本発明の第１の実施の形態に係るデータ通信システムのカメラサーバにおけるデータ送信処理を示すフローチャートである。

【図８】本発明の第１の実施の形態に係るデータ通信システムのクライアントにおけるデータ受信処理を示すフローチャートである。

【図９】本発明の第１の実施の形態に係るクライアントにおける受信レイヤ変更処理を示すフローチャートである。

【図１０】本発明の第２の実施の形態に係るデータ通信装置の構成例を示すブロック図である。

【図１１】本発明の第２の実施の形態に係るＲＴＰＪＰＥＧペイロードヘッダの構成を示す説明図である。

【図１２】本発明の第２の実施の形態に係るＲＴＰヘッダの構成を示す説明図である。

【図１３】本発明の第２の実施の形態に係るＦＥＣデータ生成時にフラグメントが発生する場合を示す説明図である。

【図１４】本発明の第２の実施の形態に係るＦＥＣデータ生成方法を示す説明図である。

【図１５】本発明の第２の実施の形態に係るＦＥＣペイロードヘッダの構成を示す説明図である。

【図１６】本発明の第２の実施の形態に係る受信系列の選択を行う処理を示すフローチャートである。

【図１７】本発明の第２の実施の形態に係る閾値選択を行うためのテーブルを示す説明図である。

【図１８】本発明の第２の実施の形態に係る送信系列のグループ化の例を示す説明図である。

【図１９】本発明のプログラム及び関連データを記憶した記憶媒体の記憶内容の構成例を示す説明図である。

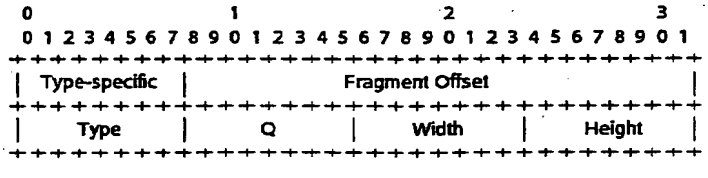
【図２０】本発明のプログラム及び関連データが記憶媒体から装置に供給される概念例を示す説明図である。

＊【符号の説明】

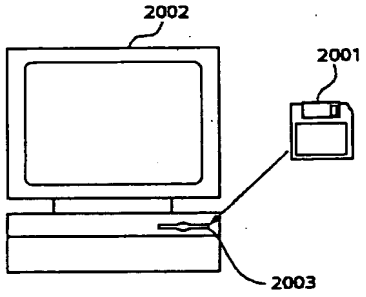
１－１　送信端末
１－２１、１－２２　受信端末
１－３、３００　ネットワーク
１－１１　データ生成部
１－１２１　レイヤ１送信部
１－１２２　レイヤ２送信部
１－１２３　レイヤ３送信部
１－１２４　レイヤ４送信部
１－１２５　レイヤ５送信部
１－２１１　データ受信部
１－２１２　データ処理部
１－２１３　受信レイヤ選択部
１－１２４　受信状況モニタ部
１０　カメラサーバ
２０　クライアント
１００　カメラ
１０３、２０３　ＣＰＵ
１０９、２０９　通信インタフェース
２０８　表示装置
１００１　送信側端末
１００２　受信側端末
１０１０　画像キャプチャ装置
１０１１　符号化装置
１０１２　データ送信部
１０１３　ＦＥＣデータ生成部
１０１４　ＦＥＣデータ送信部
１０３１　データ受信部
１０３２　ＦＥＣデータ受信部
１０３３　エラー訂正部
１０３４　復号装置
１０３５　画像表示装置
１０３６　受信系列選択部
１９０３　プログラム実行ファイル
１９０４　プログラム関連データファイル
２００１　記憶媒体

【図１１】

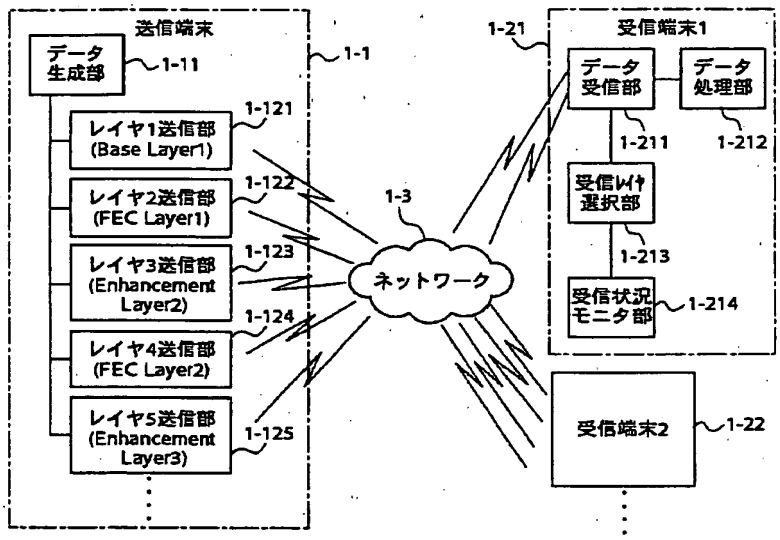
RTP JPEG ペイローダヘッダ



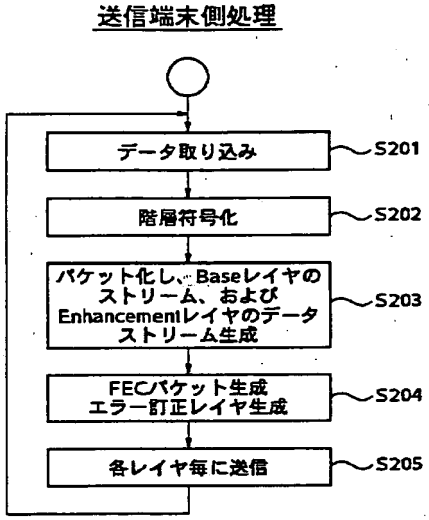
【図２０】



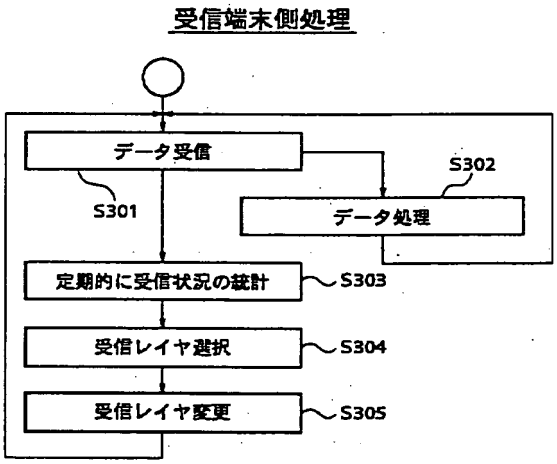
【図１】



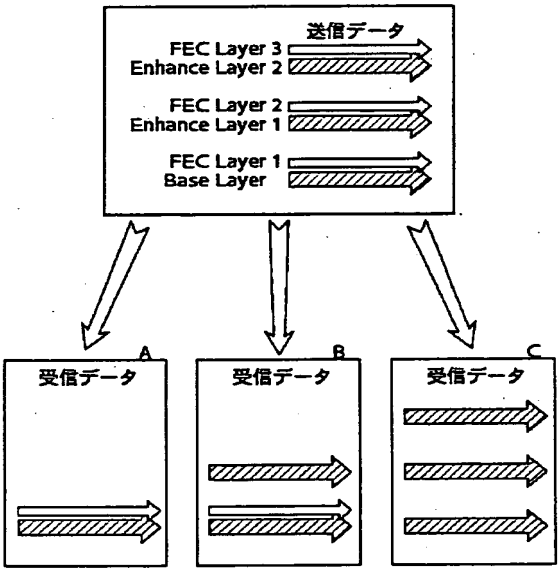
【図２】



【図３】

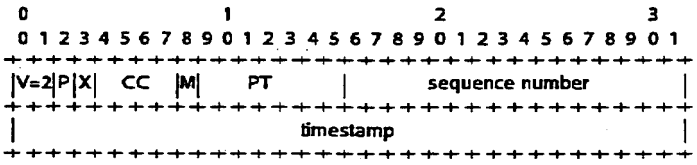


【図５】



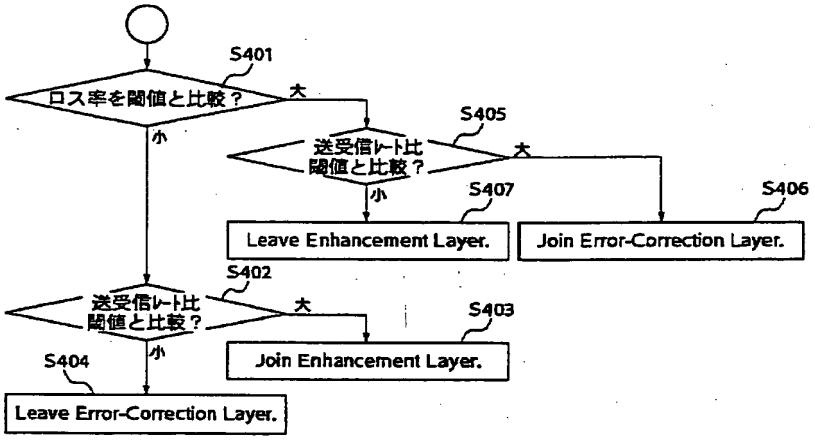
【図１２】

RTP ヘッダ（先頭 8byte）

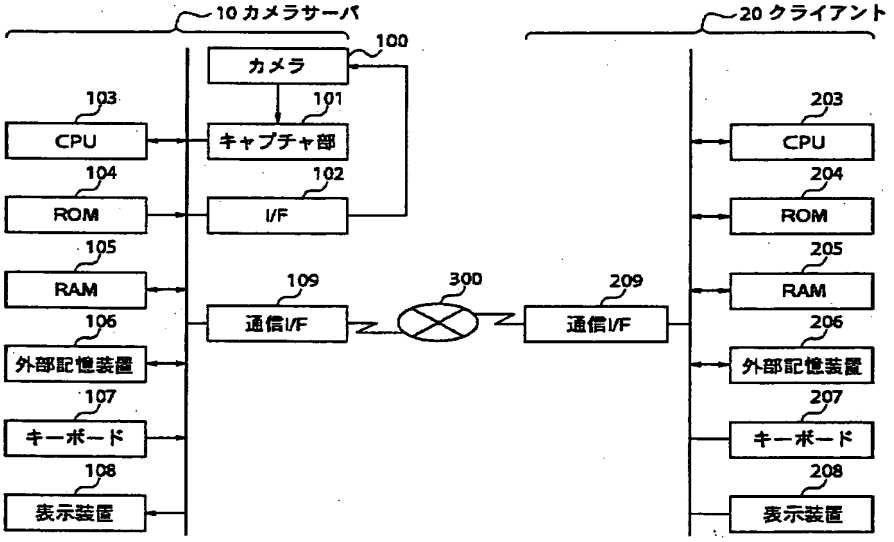


【図４】

受信レイヤ選択処理

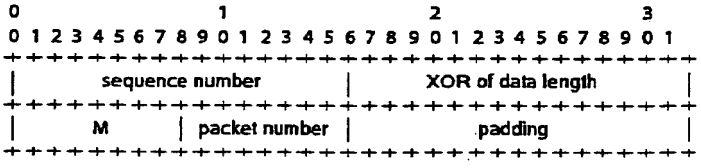


【図６】



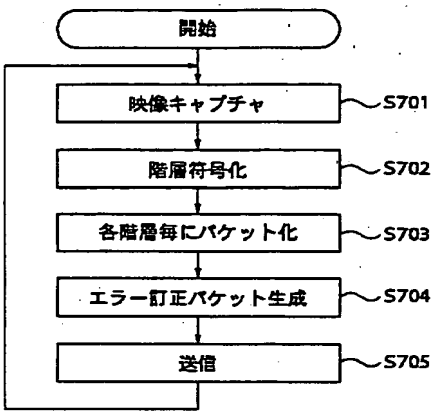
【図１５】

RTP FEC ペイローダヘッダ



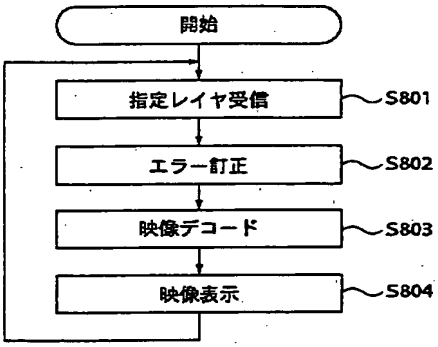
【図７】

カメラサーバの処理



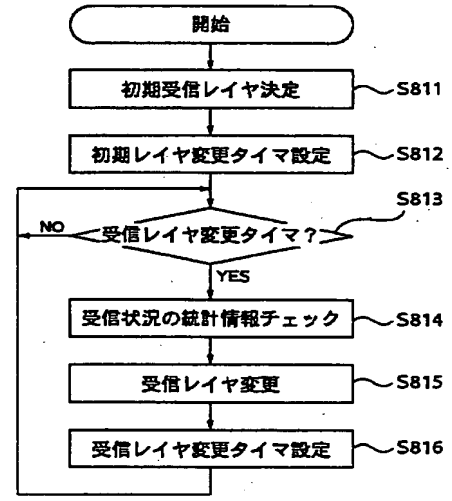
【図８】

クライアントのデータ受信処理

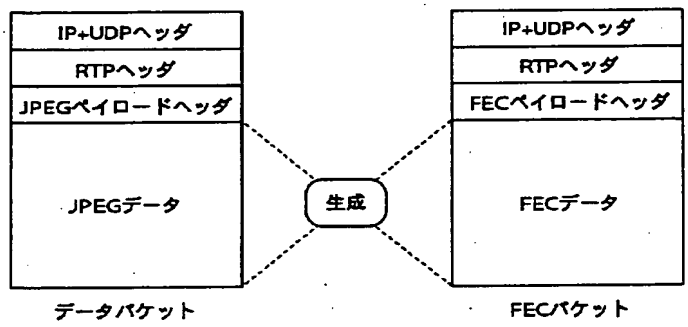


【図９】

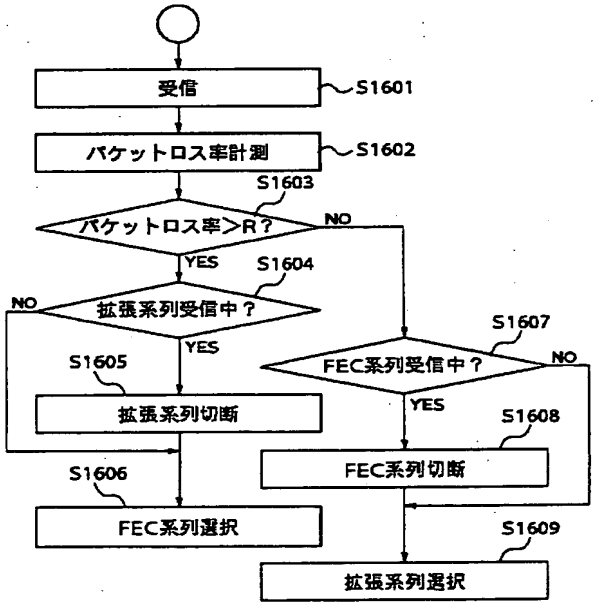
クライアントの受信レイヤ変更処理



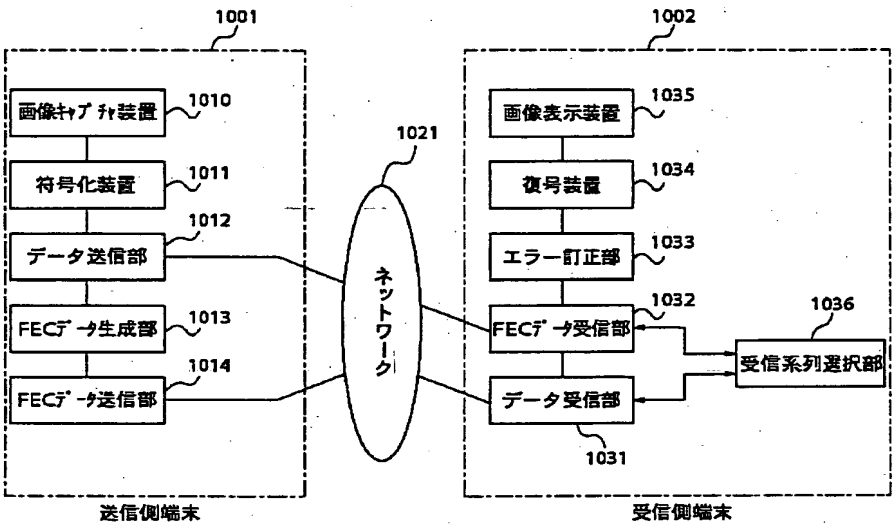
【図１４】



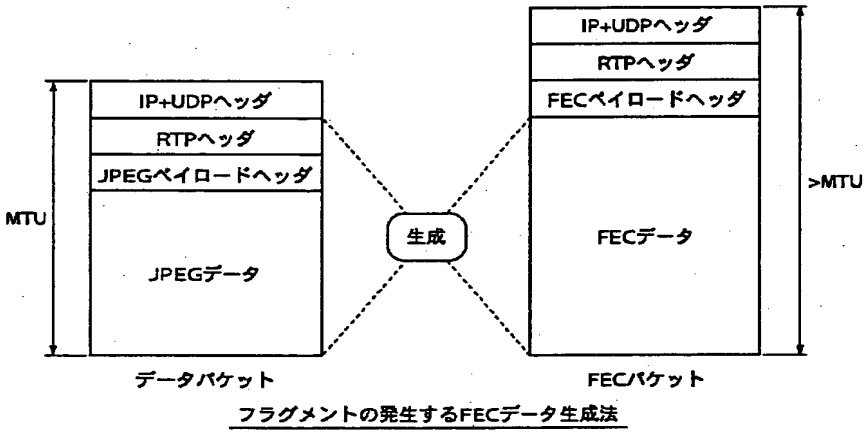
【図１６】



【図１０】

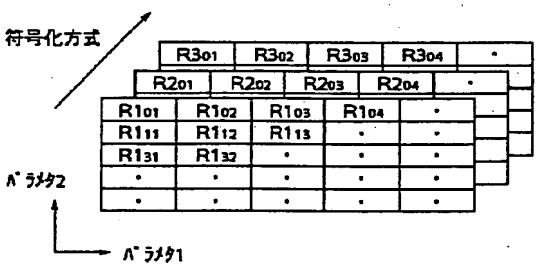


【図１３】

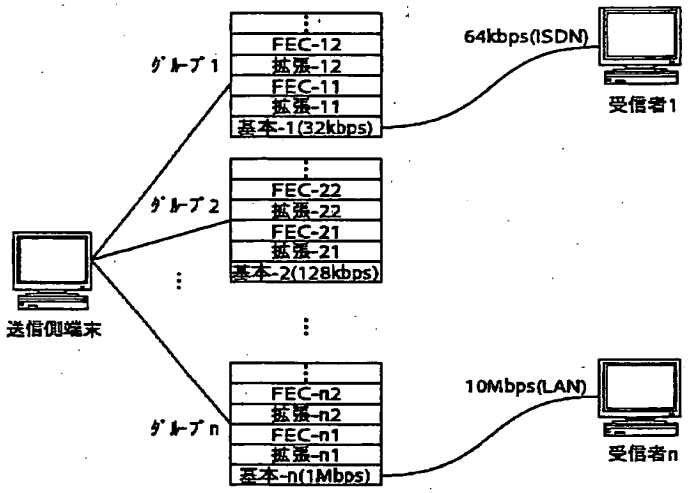


フラグメントの発生するFECデータ生成法

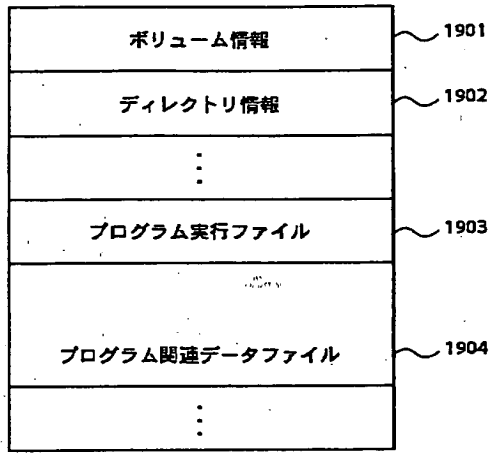
【図１７】



【図１８】



【図１９】



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5K034 AA02 AA05 CC02 MM01 MM18 QQ08
9A001 CC04 CC06 EE04 HH27 JJ27 LL05